Electrical World

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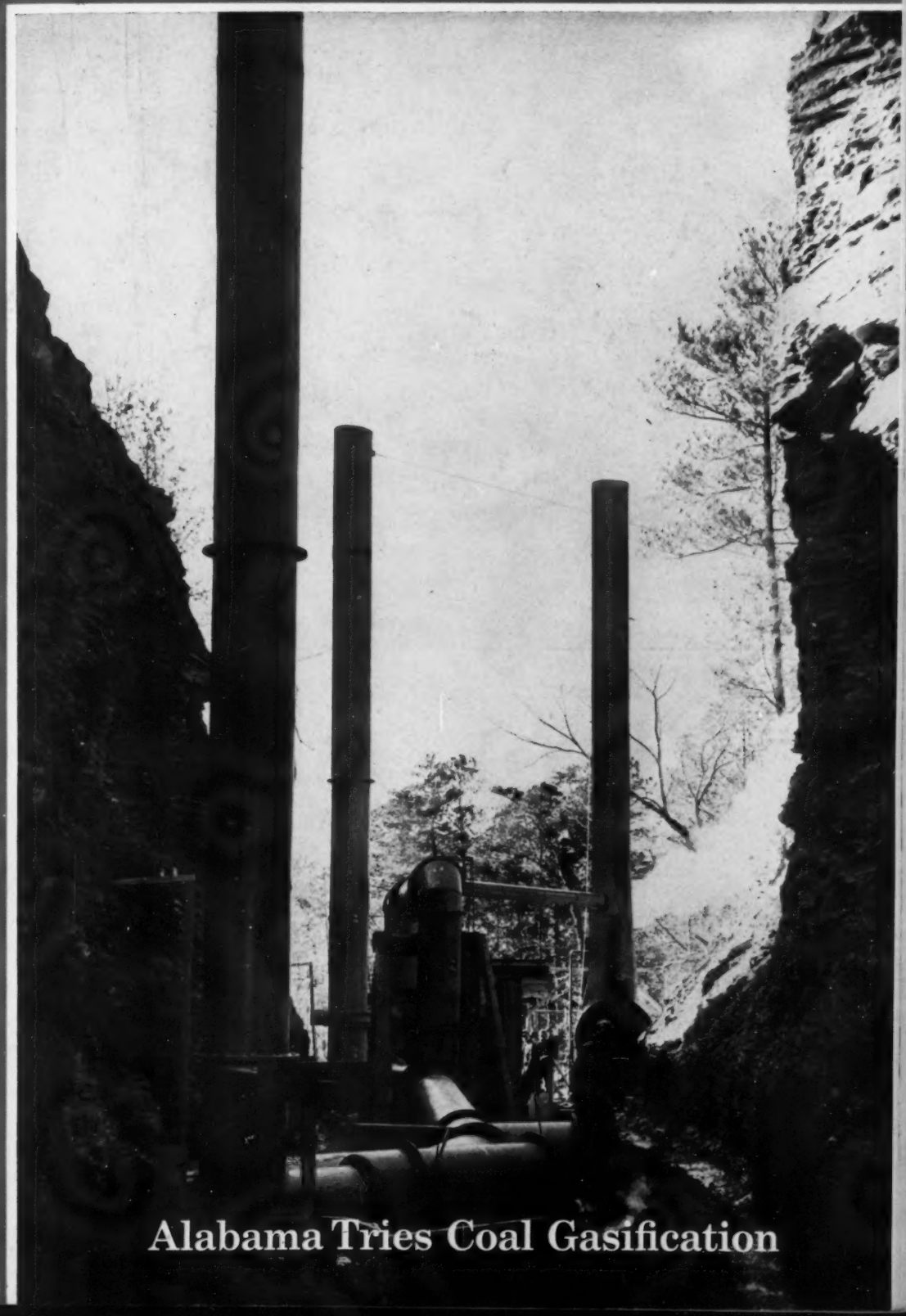
APRIL 26
1947

Features

How Georgia Installed Oilostatic Cable

Toward Improving the German Air Breaker

Better Infra-red Layout for Baking Oven



Alabama Tries Coal Gasification

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The Ultimate Answer

ONE THING may be said for the increasing labor unrest afflicting the public service industry in recent years. It has produced considerable exertion aimed at solving the problem. It has produced, however, opportunities to test various governmental solutions, notably those of three states.

The three existing state laws differ substantially. Congress also is wrestling with the problem, not precisely along lines followed by the states.

New Jersey, first state to legislate specifically regarding utility labor disputes, failed to include penalties. Doubtless this emanated from a desire to be perfectly fair. This scuttled the "Edge Act" immediately. Faced with an undisguised breakdown of law, the legislature enacted severe penalties. These were promptly ignored, leaving the state in a dismaying position. Either it has to fine and/or jail some thousand workers, or ignore a second deliberate violation of the law. Plainly, New Jersey does not yet have the answer.

Pittsburgh did not find the answer last fall when it entered the broad field of equity in search of an injunction to protect the public interest. The possibility that Pittsburgh had a sound legal case still makes for fascinating conjecture; but it is academic.

Virginia's law worked effectively in the first week of the telephone strike. Perhaps the Old Dominion has the answer, but this will be open to question until such time as a utility labor dispute there runs its full course—through the two required negotiation conferences, and the five-weeks waiting period during which the governor will make attempts to man the plants with or without their normal complement. If, then, and in the face of a real determination to strike on the part of many workers, service be maintained, it will prove difficult to discount Virginia's answer. In the absence of such a test, who can say the answer has been found?

In its first week of test, Indiana's new law also proved effective, though unpopular with the telephone workers. Since it bars strikes during the period when prearranged steps toward settlement are being followed, it too is susceptible to breakdown before the challenge of a group determined to strike. But it does stipulate that the dispute shall be arbitrated with appropriate safeguards, and that the award shall be binding. Thus, it guarantees a settlement, something the Virginia law does not do. Consequently, it seems that Indiana is at least closer to the answer.

For those areas not yet plagued with serious labor disputes, the answer is less difficult. Let them continue and strengthen to the fullest extent the good employee relations which have kept peace. Let systems troubled by labor disputes cultivate best possible employee relations. Let all systems strive to inculcate in workers the one point that seems most basic of all—the unquestionable necessity of maintaining dependable, efficient public service at all times, completely without regard to any other considerations. The ultimate answer to protecting the public service lies here.

★ ★ NEWS OF THE

Interior Budget Slash Opens Way for Major House Fight

Western Congressmen Attack Reduction of Interior Budget from $295,420,420 to $156,538,513—Reclamation Funds Cut to $62,717,600—All Agency Appropriations Earmarked

A MAJOR House fight is in prospect over the Interior Department Appropriation Bill for fiscal 1948. Debate on the measure, which opened Thursday, centered about the 47 percent slash in budget estimates for the department, as recommended by the Appropriations Committee.

Public power enthusiasts were quick to observe that in slashing nearly $139,000,000 from Interior's proposed budget the committee recommended reductions totaling more than $99,000,000 in the estimates approved by the Budget Bureau for four agencies dealing with energy production—Reclamation Bureau, Bonneville Power Administration, Southwestern Power Administration, and the Division of Power.

The House debate quickly developed into a struggle between economy-minded Eastern Republicans, who supported the committee's proposed cuts, and a combination of Democrats and Western Congressmen of both parties, who were opposed. Leaders of the economy drive expressed little hope that all the reductions would stand up, predicting that part of the funds would be restored in the House and still more in the Senate.

Most surprising of the committee's recommendations was the elimination of all funds for the Division of Power, which had come in for only $131,917, and the addition of language in the bill specifying that no funds available to the Secretary should be used for this agency. The division, which passes on power plans and contracts made by other agencies of the department, was thought to present too small a target to attract the economy knife.

Also slashed from funds for the Secretary's office, of which the power division is a section, was an item of $32,500. This sum would have financed an organization to market energy produced at hydro projects built by the Army Engineers in the Southeast, including Cumberland River, Buggs Island, Clark Hill, and Allatoona Reservoir. One member of the Appropriations Committee termed the proposal the "beginning of a Southeast Power Administration."

A more impressive slash was the reduction of the Reclamation Bureau budget from an estimate of $145,952,200 to $62,717,600. The last Congress appropriated $109,497,108 in new funds for reclamation in the current fiscal year. Also more or less expected were the reductions in the budget estimated for Bonneville Power Administration — from $20,278,000 to $6,907,800—and South-western Power Administration—from $3,925,000 to $1,371,000.

Reclamation Bureau construction funds were set by the committee at $55,258,600 in new appropriations, plus an unexpended balance of $85,826,767 which will be available as of June 30, 1947, from previous appropriations. However, the committee's report noted that the bureau would have only $51,874,796 unobligated from previous appropriations at the end of the current fiscal year.

The slash in Reclamation and other construction was typical of the committee's action in reducing the total Interior budget to $138,881,907 from an estimate of $295,420,420. The committee reported that: "It is not wise management for the government to plan and go forward with millions of dollars in construction at a time when private business is anxiously seeking in the market place the same commodities for which government will be the priority buyer if construction projects requested by the Department of the Interior are allowed in full."

The President's freezing of public works construction last August, though twice modified subsequently, had the effect of slowing Reclamation Bureau construction to the extent that it was unable to expend all available funds this year, the committee asserted. "At the rate of construction contemplated by the President's "freeze order," the Bureau had available this year enough funds "to provide construction for nearly 2½ years," the report added.

Several major policy changes were made in the drafting of reclamation's appropriations. The committee disallowed all appropriations from general funds of the Treasury for project construction, appropriating for all such works from the Reclamation fund "in accordance with the basic Reclamation Plan." Noting that this revenue base must be broadened to care for future projects, the committee recommended that "the appropriate legislative committee give consideration to the problem."

For the first time, the committee earmarked all funds for every Interior agency, including Reclamation, for specific purposes. In addition, it warned the Reclamation Commissioner to show increased costs of construction in preparing irrigation contracts for new or uncompleted projects.

Major construction programs by the bureau were approved as follows:

Project	*Budget Estimate*	*Appn. Bill*
Davis Dam	$18,000,000	$6,200,000
Central Valley	20,000,000	6,900,000
Colorado-Big Thompson	14,000,000	4,815,000
Hungry Horse	4,500,000	1,550,000
Columbia Basin	27,500,000	9,435,000
Fort Peck	2,500,000	1,250,000
Missouri River Basin	23,000,000	9,611,000
Colorado River Basin	4,800,000	3,400,000

Funds for California's Central Valley project include the following amounts for power and related facilities: Shasta power plant, $427,800; Keswick Dam, $100,740; Keswick Power plant, $218,040; 230-kv. transmission line from Shasta to Delta, via Oroville and Sac-

Copper Bill Passed

Both the Senate and the House this week passed an amended version of the Patterson Bill suspending the 4-cent excise tax on copper imports for two years and sent it to the President for his signature. The amendment tacked on by the Senate Finance Committee excludes copper sulfate from the provisions of the bill.

ramento, $256,680; 69-kv. line, Contra Costa Canal extension, $71,760. Only other major power item in the Reclamation budget was $443,000 for use on the Shoshone project.

Most spectacular cut in the Bonneville budget was the elimination of funds for all except two projected substations. The committee explained that "such facilities should be constructed by the local area or district which will benefit from the purchase of power at low cost." A total of $4,255,800 was approved for construction of eleven transmission lines. Noting that, as of January 1, 1947, BPA had an unobligated balance of $6,453,899 and an unexpended balance of an additional $11,000,000, the committee also rejected Bonneville's request for a contract authorization of $6,000,000 above appropriated funds.

The committee earmarked Southwestern Power Administration's budget as follows: Weleetka substation, $500,000; West Plains-Thayer feeder line, $171,000; general plant and equipment, $300,000; plans and specifications, $25,000; administration and engineering, $250,000; operation and maintenance, $125,000.

Too Much Light

While most communities are seeking more lights for their highways and bridges, Cuyahoga County (Cleveland) Engineer Albert Porter has asked the Ohio State Highway Department's permission to either turn off or remove the street lighting on the Brookpark Road bridge.

Located about a half mile from the Municipal Airport, the brightly lighted, 1,918-ft. bridge appears to many pilots to be a landing strip at the airport. Conditions are worsened by the almost complete absence of illumination on roads leading to the bridge.

An airplane accident last fall is attributed in part to the bridge, and officials of the airport, airlines, and the CAA are supporting Porter's request.

Utilities' Quick Action Restores Electric Service at Texas City

Power Restored in 3 Hours Except in Explosive-Torn Area along Waterfront—Community Public Service Credits Other Companies for Aid—Total Damage to System Unestimated

EXPLOSIVES and flame which leveled much of Texas City's industrialized waterfront area last week failed to disrupt the electric power system elsewhere in the city for the remainder of the day.

The hospital and water pumping plant were served in two and one-half hours.

While aid crews and equipment sped to the scene from neighboring Houston Lighting & Power and Gulf States Utilities systems, employees of Community Public Service Co., which serves Texas City with power. gas, and water, made minor repairs to a 66-kv. transmission line and checked substations. Before nightfall, that part of Texas City which could use it had power. Water was never affected.

Community, which a week earlier had been struck by another disaster—the tornado which crushed across the Texas Panhandle into Oklahoma—reported even graver damage in Higgins, Tex., as a result of the wind storm, than it suffered at the Texas seaport. At Higgins, where it once served 300 meters, it had only 20 remaining after the tornado. In Texas City, aside from the water front area, damage was reported as small, less than was anticipated.

Texas City obtains its energy from Houston Lighting & Power over a 40-mile, 69-kv. transmission line. Community's Board Chairman, Alexander Macomber, told ELECTRICAL WORLD at Boston, this week, that the service restoration was made possible through the assistance of Houston Lighting and the cooperation of equipment suppliers, particularly Westinghouse Electric Corp. and General Electric Co.

There was no damage to Houston Lighting property, according to J. H. Grant, a vice-president.

Direct from-the-scene reports state that, of Community's 35 employees in Texas City, the only injured is a cashier of the local office, Mrs. Velma Turner, who was cut by flying glass. However, every one of the employee's homes was damaged or destroyed.

Service in two main circuits serving the business district was restored in three hours. Distribution circuits serving 75 percent of customers outside stricken dock area were back by nightfall.

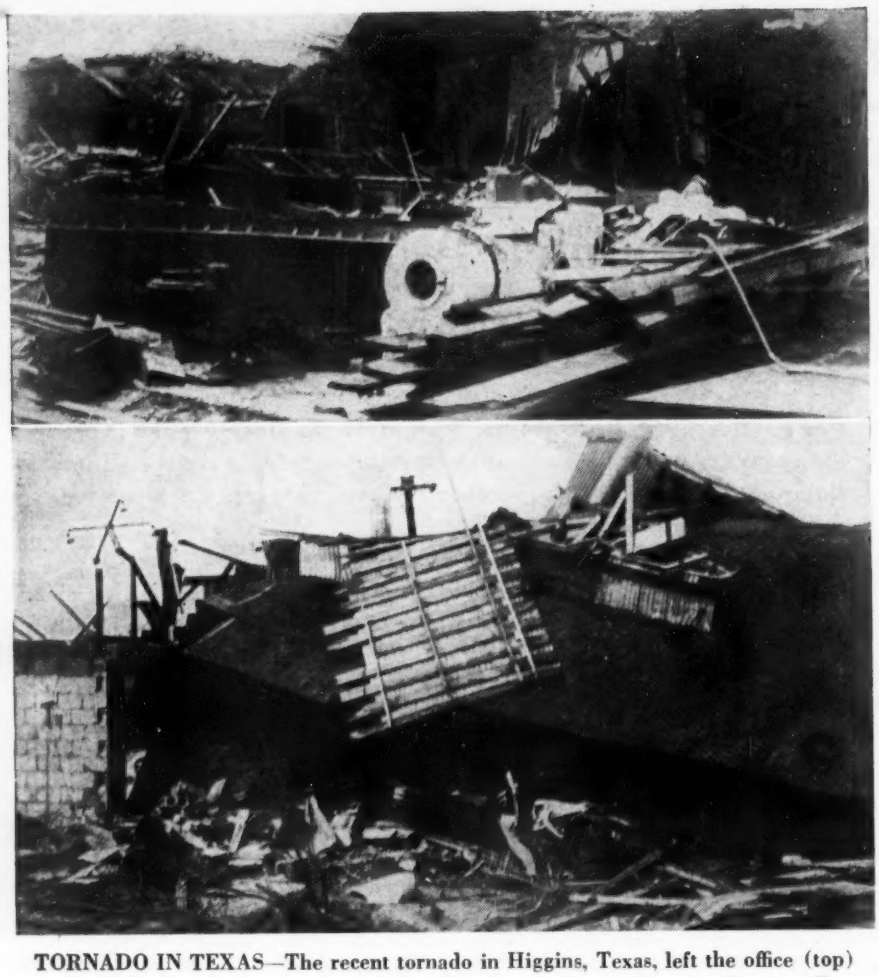
Standby diesels powered water pumps immediately after initial blast. Subsequently, an unused 11-kv. line from Dickinson, 12 miles away, was energized to take over pump load and part of business area.

One of two 69-kv. circuits from Lamarque was cut by flying steel but another was cleared through to the main substation where three 500-kva. transformers were found workable, although eight others had been damaged. Service on the cut 69-kv. circuit was restored in two days, making power available to the refineries. Oil fires hampered this work greatly.

Few individual transformers around the city were damaged. Preliminary check of meters disclosed few damaged but more may show defects on testing. Community serves 12 large industries, 670 commercial customers and 3,500 residential meters.

Apparently completely destroyed was a 2,000-kw. steam-electric generating plant, of two units and served by five 45,000-lb.-per-hour boilers, located within the destroyed chemical plant of the Monsanto Chemical Co. Heavy damage was reported to a 5,000-kw. standby, diesel-powered generating plant owned by Community in Texas City. It was believed, however, that some of its units could be restored to service.

President R. L. Bowen, of Community, flew over the disaster scene in



TORNADO IN TEXAS—The recent tornado in Higgins, Texas, left the office (top) and standby plant of the Community Public Service Co. in this ruined state. Two employees in the plant who were attempting to put it into operation escaped with minor injuries when it collapsed

his own airplane within two hours after the first blast touched off the disaster.

"Unless you actually saw the damage and destruction, you couldn't imagine how terrible it was," one ELECTRICAL WORLD correspondent declared.

The relief forces which neighboring utilities sent to Texas City were complete and broadly equipped. Gulf States, with headquarters at Beaumont, 110 miles away, sent two emergency FM radio cars, which it placed at the disposal of the American Red Cross' Beaumont chapter. One, operated by Gulf States' Carol Laughlin, communications service man, went to Texas City. Another, with an operator, was stationed mid-way between the disaster scene and Beaumont, where, for 24 hours, it relayed Red Cross and police messages from the blast scene, according to Kenneth Sutton, Gulf States publicity director.

Six aid crews were sent by Houston Lighting, including three heavy line crews and one substation crew. Seven H.L.&P. nurses, along with company safety supervisors, entered the stricken city. The nurses worked all night in the operating rooms. An H.L.&P. crew operating portable lighting equipment also worked with the other relief groups until Community could get its own crews to the scene from Fort Worth.

Other utilities escaped relatively lightly, despite the intensity of the blast and fire which racked the waterfront area. Telephone company officials, who got service "substantially restored" by mid-afternoon on the day of the blast, estimated that $24,000 worth of damage was done to buildings and equipment, aerial cable and PBX installations.

A 16-in. gas feeder main into the city was temporarily closed pending inspection. Gas was returned to the mains the same day.

Community, Macomber asserted, expects to restore full service to what remains of the waterfront area within 60 days. Here, power is supplied to industries, largely refineries, through substations. At mid-week, refineries were rapidly returning to operating condition. Power service was restored to the first two days after the blast, and to another three days later. Monsanto and certain other industrials will take from six months to a year to recover, Macomber added.

To speed the rehabilitation of industrial equipment, General Electric ordered its Southwestern engineers and service shops onto a 24-hour standby basis to render emergency repairs. Shops at Houston and Dallas are to receive turbine-generators and other electrical equipment.

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Virginia Will Seize Phone Lines if Strike Continues

Preliminary steps leading, if necessary, to seizure of the Chesapeake & Potomac Telephone Co. under Virginia's anti-utility strike law had been taken this week as the telephone dispute remained unsettled in Virginia and the strike continued in other parts of the country where state laws did not intervene.

Virginia telephone workers have been barred from striking for five weeks after final notice was given Gov. William M. Tuck of failure of bargaining. To prevent a walkout at the end of that time, Gov. Tuck has issued proclamations that the commonwealth would seize the telephone facilities at 6 a.m., May 14, in areas adjoining Washington and at the same hour, May 17, in the rest of Virginia.

Seizure was declared necessary "to protect the public health, safety, and welfare."

One of the steps in planning the seizure is to determine how many employees will continue to work so that the state may know how many replacements would be needed. Accordingly, the State Corporation Commission this week polled all C. & P. employees, including supervisors and executives, on the question.

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Power Dam Dynamited

Carrying out an abatement order signed by a Washington superior court, engineers for the state game and fisheries department recently supervised the blasting of the Western Light & Power Co. Cottrell dam on the Washougal River. The structure was dynamited to allow steelhead trout in the river to reach their natural spawning ground this spring. Destruction followed several years of litigation. W.L.&P.'s gross revenue from power generated at the dam in 1946 was only $1,700.

E.E.I. Committee Advocates Federal Energy Tax Repeal

Study by New York University Experts Shows the Tax to Be Inequitable, Discriminatory, and Inordinately Costly Both to Government and Taxpayer—Net Return but $27,000,000

THE 3.3 percent federal tax on electric energy sales is an inequitable "nuisance" tax which is not only discriminatory but also "inordinately costly," both to the government and the taxpayer. It produces relatively little revenue, and it is extremely difficult to determine precisely to which sales it is applicable.

Basing its action on these findings, the Taxation Accounting Committee of the Edison Electric Institute has recommended that the tax be repealed. The recommendation came in a report to E.E.I. which was based on a study by Dr. H. B. Dorau and Dr. J. Rhoads Foster, both of New York University.

Originally enacted in 1932 as a revenue raiser placed directly on the consumer, the tax was revised a year later with the asserted intention of placing it on electric utilities rather than their customers, the report asserted. It was confined to energy sales to domestic and commercial consumers, and sales by publicly owned suppliers of energy were exempted.

Tax Exemption Noted

The E.E.I. committee's report noted that the tax does not apply to privately owned, non-utility power suppliers, and asserted that this exemption can be the decisive factor in the mind of a consumer attempting to decide whether to buy power or generate it himself. To the extent that such a decision drives business away from central-station suppliers, the report adds, the tax can only increase costs to those consumers unable to generate their own power.

As a revenue producer, the committee report concludes, the 3.3 percent tax is ineffective. Today, the federal government derives less than 1 percent of its $6,854,000,000 total excise taxes from the energy tax—or about $59,000,000 gross. This, the report asserts, is reduced to about $27,000,000 of net effective tax. Because payments for energy taxes are deductible by utilities for income tax purposes, the net effective return on the energy tax is reduced to $36,000,000. In addition, from 25 to 40 percent of this $36,000,000 is reflected in the service rates paid by commercial customers, and thus is deductible by them from income tax returns, reducing the net effective energy tax again, to $27,000,000.

The E.E.I. committee report particularly criticizes the 3.3 percent tax as impossible of accurate classification as beween taxable and non-taxable uses. Where the consumer may be either a "commercial" or an "industrial" user, determination must be made by the utility on the basis of the "predominant character of the business." The utility, however, has no power to compel disclosure of the facts necessary to any such decision. To make them, it must incur substantial expense and use a large force of highly-trained people. The committee estimated that the $27,000,000 of net revenue derived by the government costs the electric utility industry at least $2,000,000 yearly, and the government an additional amount for administrative expenses. This, the report describes as "a most unreasonable ratio to the yield."

In their report to the E.E.I. committee, Dorau and Foster asserted:

"The statistical relations derived lead unavoidably to the conclusion that the federal electric energy tax is unequally distributed and is an inequitable and uneconomic burden on investors or consumers and more particularly that:

"1. It is unequally and unfairly distributed among utilities;

"2. It bears more heavily on utilities with small net incomes;

"3. It bears more heavily on smaller electric utilities;

"4. As a burden on consumers, it is unequally distributed among electric utilities;

"5. It bears heavily on utilities with smaller operating incomes;

"6. As a burden on consumers, it is heavier on consumers served by smaller utilities;

"7. If the impact of other federal taxes is equitable, its impact. . . .is inequitable;

"8. It is grossly discriminatory among consumers of electrical energy by completely exempting the consumers served by 2,130 municipal, county, state and federally owned electric utilities and 725 cooperatively owned electric utilities (1944) from the burden of the tax;

"9. It singles out for discriminatory taxation the utilization of energy in one form and exempts energy competitively available in other forms, resulting in a distortion of the national energy resource consumption pattern."

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New 25-Year Franchises

Mississippi Power Co. has secured new 25-year franchises in Biloxi and Bay St. Louis.

McCALL AWARD PRESENTATION—Miss Marguerite Fenner, left, home service director, Pacific Gas & Electric Co., receives the McCall Award, offered by McCall's Magazine for outstanding accomplishments in home service during 1946, from H. M. Sawyer, chairman of the Edison Electric Institute's Prize Awards Committee, at the recent annual sales conference of E.E.I. at Chicago. Camille Davied, executive editor, McCall's Magazine, is at right

Need for Planning Ahead Emphasized at Conference

Missouri Valley Group Studies Methods of Improving Service—Construction Delays Reported

While plans for construction and methods of improving service held attention in the meeting papers and discussions at the Engineering Conference of the Missouri Valley Electric Association in Kansas City last week, discussions outside the meeting rooms turned invariably to shortages and construction delays. The immediate problems gave emphasis to the need for planning to anticipate further ahead in the addition of system facilities.

This conclusion of C. S. Roadhouse, Omaha Public Power District, appeared to summarize the general feeling in discussions of networks, relaying, cables, transmission improvements, and other special subjects. He felt that heavy overloads and excellent system performance during the war give confidence in the basic designs but clearly indicate requirements for expansion to supply higher load densities.

Home Users Build Load

A prediction that residential load growth would lead to an important extension of the secondary network system was made by John Parsons, Westinghouse Electric Corp. He outlined the loop or ring plan with two primary overhead feeders, three-phase transformers, and simplified protectors as particularly fitted for apartment house and small commercial areas.

Many questions during discussion of aerial cable practices showed a wide interest but indicated also that many problems remain on methods of construction. F. P. Gilpin, Kansas City Power & Light Co., opened the subject with a review of operating practices. He found that the value of shielding on cables below 5 kv. is questioned although it is considered essential at higher voltages.

Growth of distribution grids makes necessary many more complicated short circuit calculations, said J. N. Banky, Allis-Chalmers Manufacturing Co., in offering an approximate method using reactance ratios.

Increased use of electric water heating has transferred the problem of off-peak control from generation to distribution, in the opinion of W. H. Zillger, Line Material Co. This necessitates more flexible and accurate control, with variations in time from day to day, and with group control essential, he concluded.

Perry Peterson, Control Corp., said that centralized control of many parts of the power system gives better coordination and permits action more promptly than with instructions communicated to other operators. With supervisory control, it is as important for the operator to know what is going on as it is to be able to control operations, he added.

S. C. Leyland, Westinghouse, said that protection of lines with more than two terminals must use carrier or pilot-wire relaying for best results, and the use of directional relays is accompanied by compromises to provide selective relaying. Frank S. Dlouhy, Oklahoma Gas & Electric Co., reviewed operating experience with a quick-reset feature which they installed on relays in 1939. He concluded that in conjunction with instantaneous relays this has been responsible for an increase in the percentage of successful immediate reclosures and a decrease in the percentage of circuit breaker lockouts.

S. B. Farnham, General Electric Co., stated that there may be some basis for taking "calculated risks" in applying lightning protection to parts of the system that can be repaired by a replacement unit. But, large power transformers and rotating machines, where time to repair may be months, justify the maximum possible protection.

NO TRIVIAL MATTER—H. S. Sutton, treasurer of the Consolidated Edison Co. of New York, receives a check for $97,518,511.11 from a representative of Morgan Stanley & Co. as final payment for the utility's $100,000,000 bond issue sold to refund existing mortgage bonds. From left to right are Charles B. Delafield and Charles Nodder, assistants to President R. H. Tapscott, Vice-President E. A. Baily, Mr. Sutton, Assistant Treasurer Frank C. Gordon, the Morgan Stanley representative, and Assistant Secretary Edward T. Roche

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Association Incorporates

The Nebraska Association of Rural Public Power Districts has filed articles of incorporation with the Secretary of State at Lincoln as a non-profit organization. The purpose is given as to promote the development of rural electrification in Nebraska.

Westinghouse Price Firm on Quick-Delivery Items

Firm prices on equipment available for relatively short delivery and no increase in home appliance prices is the immediate reaction of the Westinghouse Electric Corp. to its new wage contract calling for a 15-cent hourly wage increase for all employees represented by the United Electrical Workers-C.I.O.

Beyond that, Westinghouse had not ventured early this week, although indications were that some price increases, particularly on producers' equipment, might be instituted despite the present drive by the federal administration to "talk prices down."

"Further study is being given now to other lines of products, especially producers' equipment, which may require different treatment, including some price increases," declared B. W. Clark, vice-president in charge of sales. "No price advance on home appliances is contemplated at this time. Westinghouse is establishing this price policy in order to help give impetus to the stabilization of our nation's economy and in the hope that, with such stabilization, many projects, now held up because of uncertainties over costs, may be carried out."

Clark said that Westinghouse is "preparing to quote firm prices on all products where reasonably short delivery reduces the hazard. In many cases, these prices will be made firm with no price increases, in spite of the recently-announced increases in wages.

On the average, Clark added, Westinghouse prices have risen 24.5 percent since 1939, less than half the rise in all wholesale, non-farm prices.

Dondero Bill Would Deprive Interior of Control of Power

Early House Action Expected on Bill to Revise Section 5 of 1944 Flood Control Act to Return to Secretary of War Authority to Dispose of Energy from Engineers Projects

EARLY House action on the Dondero Bill—to revise Section 5 of the 1944 Flood Control Act—was predicted this week. And there were indications that two of the three federal agencies affected by the measure, the Army's Engineers and the Federal Power Commission, would actively support it despite the expected opposition of the Interior Department.

Rep. George A. Dondero, veteran Michigan Republican who introduced the bill last week, told reporters that he hoped the Public Works Committee, of which he is chairman, would begin hearings on the measure "within a few weeks."

Neither the War Department nor the FPC has reported its official views on the bill, but sources close to both agencies asserted that they long have been dissatisfied with Section 5, which established the Secretary of Interior as marketing agent for electric energy produced at all river projects built by the Engineers. The Engineers have expressed concern over what they termed "increasing opposition" to their proposed hydroelectric developments since the passage of the 1944 act, it is reported. The same sources contend that FPC would like greater control over government-produced power.

Would Revoke Preference

The Dondero Bill would go far toward meeting criticism along these lines. It would return to the Secretary of War authority to dispose of energy from Army projects under contracts and rates to be determined by FPC. The measure also would revoke the so-called "public preference clause" of Section 5, substituting the provision that preference in sales of power be given to "public bodies and cooperatives" only when such action "will not prevent full use and development of the power potentialities" of a project.

Another major provision of the bill forbids construction of federal transmission lines from Army projects except for the purpose of interconnecting federal hydro projects and then only with the specific approval of Congress. All federal transmission lines completed or under construction from Army projects would be turned over to the Army, except those under control of the Bonneville Power Administration. Bonneville operations are exempted from all provisions of the bill, Rep. Dondero explained.

"It is expected that privately owned utility companies would build transmission lines in most instances where the facilities are required, and it would be unnecessary for the government to embark on extensive transmission construction," he added.

"Present provisions (of Section 5) relating to the marketing of power from flood control and navigation dams by the Secretary of the Interior are loosely drawn and subject to individual interpretation. Under these provisions the Interior Department has attempted to set up a public power system to compete with established electric utilities and has been constantly pressing Congress to permit it to construct duplicating transmission and steam generating facilities."

A bitter opponent of Section 5 when it was enacted by Congress three years ago, Rep. Dondero asserted that it had been utilized by Interior ever since to "socialize the production, distribution, and sale of electric energy." His bill, he said, will permit private enterprise to "participate in the development of our river basins by selling increased amounts of electric power at low rates."

Wide distribution and low rates for federal power, he contended, would be assured by FPC supervision. He pointed out that FPC, through its collecting of data on all electric utilities, both public and private, is "in a unique position to understand the power needs and requirements of the nation. Furthermore, it is an independent, expert body which does not operate any electric facilities and can dispense equal treatment to privately owned projects and to federally owned projects so that the complete public interest is protected."

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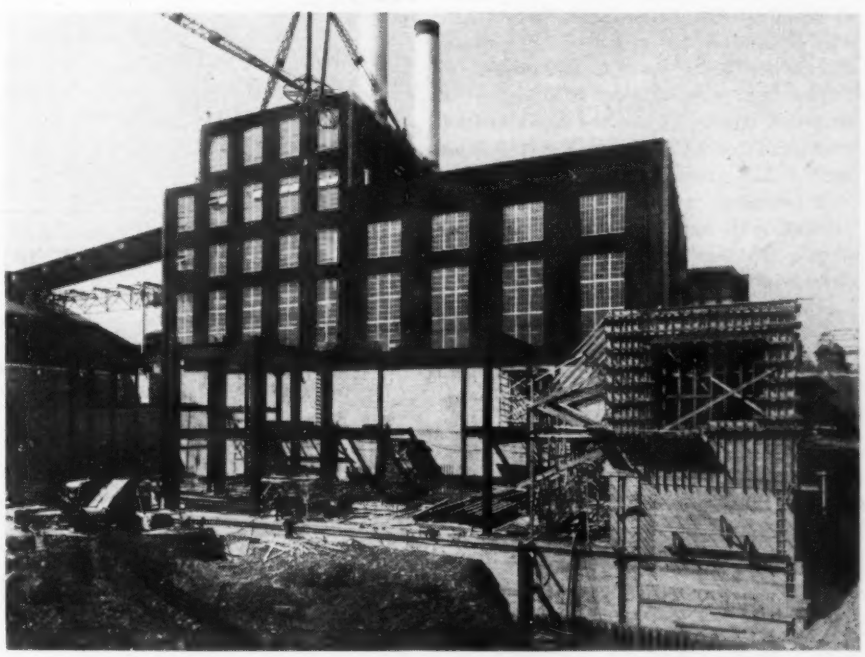
SPA Line Contract Let

Another link of the federal transmission line between the government's Norfork and Denison dams will soon be under construction. The Southwestern Power Administration recently announced that the Donovan Construction Co. of St. Paul had submitted the lowest bid—$592,742—for building 40 miles of 154-kv. line between Clarksville and Witts Springs, Ark.



PLANT ADDITION—Substructure and screen house, and the beginning of steel erection for the first 65,000-kw. unit at Cliffside plant of Duke Power Co. Another 65,000-kw. unit is to be installed giving the plant two 40,000 and two 65,000-kw. units. The two new units will be in operation next year

Peaceful Labor Front Will Assist Foes of Labor Bill

Settlement of the Westinghouse, General Motors electrical division, and U. S. Steel Corp. wage disputes without strikes is expected to be used by President Truman and the minority in Congress as argument for not putting into law the strike-control bill beginning to emerge from Congress.

The comparatively peaceful labor situation in major industries will also lessen the chances of overriding a Truman veto.

A question remains, however, whether the Republican leadership on Capitol Hill, in the event a veto were sustained, would push through measures which Truman might okay. These would include procedures for handling major disputes affecting public health and safety, like the telephone strike, and the elimination of abuses like secondary boycotts and jurisdictional strikes.

What curbs, if any, finally become law might well depend on whether John L. Lewis pulls another coal strike July 1, when government mine operation ends. The Smith-Connally Act and last year's Case Bill were both aimed at his United Mine Workers.

The House last week stiffened, rather than softened, the bill sent to the floor by the Labor Committee. It inserted a ban against strikes by government employees and barred employers, as well as employees, from bargaining industry wide. The denial of bargaining rights to unions with Communist leadership was extended to include any whose officers had ever been Communists.

The final vote, 308 to 107, indicated that the House, if not the Senate, had enough votes to override a veto. The Senate has yet to vote on its bill.

A provision in both bills would give professional employees the right to decide whether they wished to be included in the same bargaining unit with production workers.

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Iowa Management Course

The University of Iowa will offer its ninth management course from June 9 to 17. The course is designed primarily for those who want comprehensive training in production planning, job evaluation, motion and time study, wage incentives, and related subjects, and combines fundamental training with practical applications. Registrations and communications concerning the course should be sent to Ralph M. Barnes, 111 Engineering Building, University of Iowa, Iowa City, Iowa.

Call It Luck

An insulation failure on a generator at the Olmsted plant of the Utah Power & Light Co. recently started a fire. The resulting heat distorted the coils in such a manner as to cause them to strike the rotor of the generator, which in turn drove them into a cooling water line to one of the bearings. The line broke and shot water into the rotor. The whirling rotor threw the water around the generator, thus putting out the fire.

Frigidaire 'Meter Miser' to Go Commercial in May

Adaptation to commercial applications of the sealed-in, rotary compressor unit, known as the "Meter Miser," used by Frigidaire in domestic refrigerators since 1933, is now being disclosed to distributors and regional executives of the company. General announcement to the trade, including details of design and of sales plans, is scheduled for mid-May. The new unit will be available in three sizes for new equipment or for replacement of existing compressors in all kinds of commercial refrigeration, counter cases and cabinets, walk-in coolers, air conditioning, and water coolers.

Preview of sales plans, built around the economy and operating simplicity of the new unit, was offered at a meeting in New York, April 21, the second of nine such meetings at centers of Frigidaire distribution.

SEC RULINGS

The Securities and Exchange Commission recently issued a series of orders affecting electric utility companies.

MICHIGAN GAS & ELECTRIC CO. has received an extension of time from March 31 to April 30, in which company is to consumate recapitalization plan. (Release No. 7318).

ATLANTIC CITY ELECTRIC CO. has received permission to amend its charter to provide in part for cumulative voting for holders of common stock. The amendment also would provide for preemptive rights to common stockholders with respect to any offering of common stock, or security convertible into common stock, for money, other than with respect to a public offering of such shares. (Release No. 7320).

NEW ENGLAND GAS & ELECTRIC ASSOCIATION has been released from the jurisdiction of the commission with respect to the results of the competitive bidding for $22,425,000 principal amount of 20-year collateral trust sinking fund bonds and the negotiations for 77,625 shares of cumulative convertible preferred shares and such of the 479,235 common shares as are not subscribed for upon exercises of subscription rights. (Release No. 7321).

EAST COAST PUBLIC SERVICE CO. has received approval of its plan for liquidation and dissolution, after payment of outstanding first lien collateral 4 percent bonds and other liabilities, and distribution of the remaining assets to common stockholders. Preliminary to dissolution, Virginia East Coast Utilities, Inc., and Tidewater Electric Service Co., subsidiaries, will be merged with Virginia East Coast as the surviving company. The commission has applied to the Federal District Court at Wilmington, Del., for an order to enforce the plan. (Release No. 7326).

MEETINGS

Pennsylvania Electric Association—Wiring Service Committee, Green Gables Hotel, Lewistown, Pa., May 7. Howard E. Ross, vice-chairman, Pennsylvania Electric Co., Johnstown, Pa. Prime Movers Committee, Castleton Hotel, New Castle, Pa., May 15-16. R. L. Hallman, chairman, Pennsylvania Power & Light Co., Hazleton, Pa.

Great Lakes Power Club—Meeting, Indianapolis Athletic Club, Indianapolis, Ind., May 9. J. H. Miller, secretary, Indiana & Michigan Electric Co., Marion, Ind.

Edison Electric Institute—Joint meeting of Meter & Service Committee with Committee on Metering & Service Methods of the Association of Edison Illuminating Companies, Detroit-Leland Hotel, Detroit, May 26-28. W. G. Knickerbocker, chairman, Detroit Edison Co., Detroit 26, Mich.

Previously Listed

Edison Electric Institute—Engineering and Accident Prevention Committees, Edgewater Beach Hotel, Chicago, April 28-30. Annual Meeting, Hotel Traymore, Atlantic City, June 2-5.

Pennsylvania Electric Association—Communications Committee, Roosevelt Hotel, Pittsburgh, May 1-2; Transmission & Distribution Committee, Irem Temple Country Club, Dallas, Pa., May 22-23.

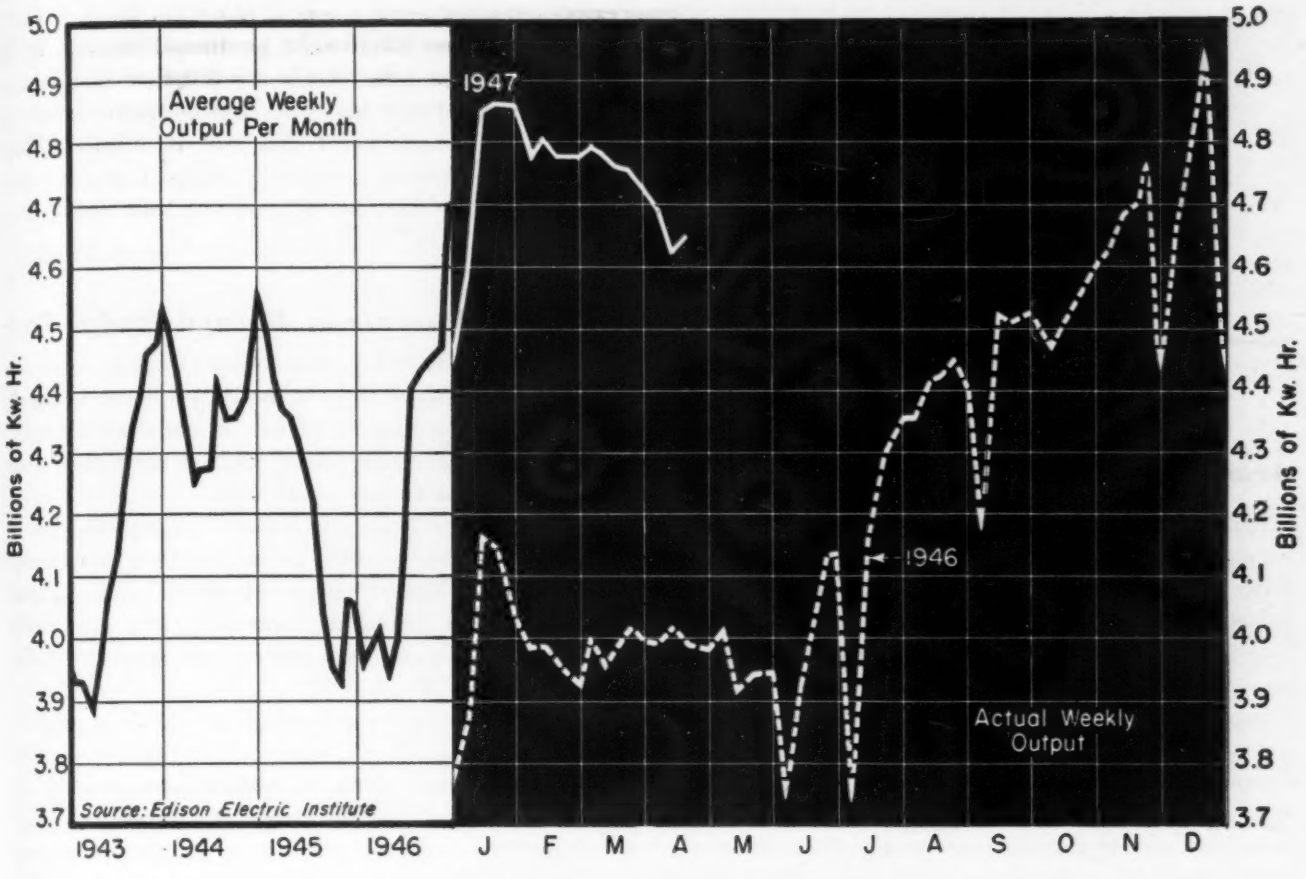
National Electrical Wholesalers Association—Annual Convention, Hotel Traymore, Atlantic City, May 4-8.

Northwest Electric Light & Power Association—Business Development Section, Olympic Hotel, Seattle, Wash., May 7-9.

Southeastern Electric Exchange—Power Sales Conference, Thomas Jefferson Hotel, Birmingham, Ala., May 8-9; Home Service Conference, Thomas Jefferson Hotel, Birmingham, Ala., May 13-14.

American Public Power Association—Annual Convention, Hollenden Hotel, Cleveland, May 21-23.

Pacific Coast Electrical Association—Annual Meeting, Mission Inn, Riverside, Calif., June 4-6.



Texas Bans Closed Shop, Restricts Utility Picketing

An act outlawing closed shop contracts in Texas and one restricting picketing in strikes where such picketing is intended to interfere with the maintenance of public utility services have been signed by Gov. Beauford Jester and will become effective 90 days after the close of the present legislative session.

Despite strong opposition of organized labor, the act barring the closed shop was passed by the Senate, 23 to 4, and by the House, 84 to 39. In a radio talk, the governor defended the act, saying that it did not destroy organized labor or take away the right of collective bargaining.

The anti-picketing measure does not entirely prohibit picketing against utilities but does forbid it where such action is aimed at disruption or interference with services or obstruction of maintenance of plants. Penalties of two to five years are provided for violations. The measure affects all utilities having the right of eminent domain but does not extend to telephone or other communications systems, despite efforts to include them.

The Senate passed the bill by voice vote with little opposition; the House vote was 117 to 4.

MARTIN AWARD—Ralph J. Bugbee, left, Central Vermont Public Service Co., receives the Thomas W. Martin award for 1946 for "outstanding performance in promotion of rural electrification" from H. M. Sawyer at the recent E.E.I. Sales Conference in Chicago

P.U.D. Takes Over Utility

The property of the Pacific Power & Light Co. in Klickitat County, Wash., became the property of the Klickitat County Public Utility District recently when the P. U. D. paid over $700,000 to the utility in federal court at Spokane. The award made by the court last September was $670,000, but improvements since raised the value.

Output Reverses Trend

Reversing the downward trend which set in early in March, the electric output curve moved slightly upward during the week ended April 19, 1947, according to figures released by the Edison Electric Institute. The amount of electrical energy distributed by the light and power companies of the country amounted to 4,660,320,000 kw.-hr., comparing with 4,619,700,000 kw.-hr. during the preceding week. During the week ended April 20, 1946, the amount of electrical energy distributed totaled 3,987,145,000 kw.-hr., this year's figure representing an increase of 16.9 percent.

Weekly Output, Millions Kw.-Hr.

1947		1946		1945	
Apr. 19	4,660	Apr. 20	3,987	Apr. 21	4,411
Apr. 12	4,620	Apr. 13	4,015	Apr. 14	4,332
Apr. 5	4,693	Apr. 6	3,988	Apr. 7	4,322
Mar. 29	4,729	Mar. 30	3,992	Mar. 31	4,329
Mar. 22	4,759	Mar. 23	4,017	Mar. 24	4,402
Mar. 15	4,764	Mar. 16	3,988	Mar. 17	4,398
Mar. 8	4,787	Mar. 9	3,953	Mar. 10	4,446
Mar. 1	4,797	Mar. 2	4,000	Mar. 3	4,472
Feb. 22	4,778	Feb. 23	3,923	Feb. 24	4,474
Feb. 15	4,778	Feb. 16	3,949	Feb. 17	4,472
Feb. 8	4,801	Feb. 9	3,983	Feb. 10	4,505
Feb. 1	4,777	Feb. 2	3,983	Feb. 3	4,539

Percent Change from Previous Year

	Apr. 19	Apr. 12	Apr. 5
New England	+10.3	+ 6.9	+ 8.9
Mid-Atlantic	+10.2	+ 6.4	+10.8
Central Industrial	+18.1	+16.9	+21.1
West Central	+18.1	+15.5	+18.2
Southern States	+18.4	+16.3	+18.0
Rocky Mountain	+22.2	+20.0	+12.2
Pacific Coast	+21.7	+23.1	+24.7
Total United States	+16.9	+15.1	+17.7

Electrical World OPINION

Army Not Hot for Electric Cooking

COOLNESS towards electric cooking is evidenced by the amount of heat Army engineers contend it requires. Twice as much, they say, as spokesmen for the electrical industry assert. And with the Army about to build 90 hospitals for the Veterans Administration, the difference between one kilowatt-hour and a half of one per ration is important.

Among the factors set up by the Army engineers for determination whether electricity or gas will be used for cooking in these hospitals are the amounts of each required for a daily ration, three meals. For a ration the factors stated are; natural gas, 5,500 Btu.; manufactured gas, 5,300 Btu.; electricity, 0.98 kw.-hr. (3,335 Btu.).

We don't know the origin of these factors. But we do know that the American Gas Association has admitted, on the basis of laboratory tests, that the efficiency of heat application of electricity for surface cooking is twice that of gas. Therefore, if as the Army says, gas cooking averages 5,400 Btu. per ration, then electric cooking should take only 2,700 Btu. Which is 0.79 kw.-hr., considerably less than the Army figure of 0.98.

Furthermore, the electric cooking champions argue—and it sounds reasonable—that the A.G.A. tests were made under laboratory conditions never or very infrequently duplicated in practice. One can hardly believe that the cooks in veterans' hospitals are going to see to it that gas and air mixtures are always adjusted in exactly right proportion, that burners are meticulously clean, that bottoms of cooking utensils are never more nor less than proper height above the flame, that, in short, gas equipment is kept always in condition like new and cooking practices never stray from perfect efficiency.

Considering, against this, that electric surface cooking is a matter of metal to metal heat conduction, it is claimed that the edge of electricity over gas is not two, but three to one. On this ratio, the Army's average of 5,400 Btu. per ration for gas corresponds to 1,800 Btu. for electricity. Which is 0.53 kw.-hr., a whole lot less than 0.98.

For some more evidence, let's drive back into history. In ELECTRICAL WORLD, October 4, 1930, is an article describing electric cooking at Genesee Wesleyan Seminary, Lima, N. Y. Students and teachers numbered 150. Average energy consumed per meal was 0.271 kw.-hr. That would be in Army terms 0.813 kw.-hr. per ration. With its 0.98 figure then, the Army says in effect that in the past 17 years not only has there been no improvement in electric cooking equipment, but that its efficiency has decreased. The Army is generally regarded as conservative. But in this case, doesn't it seem a little ultra?

Canadian Outputs at Record Highs, Too

FOR what ever comfort they can extract from it, operators of electricity supply systems in the United States can look north across the famous 3,300 miles of undefended border and see their Canadian colleagues also struggling with record loads and energy productions.

In January, 1947, output of Canadian central electric stations was nearly 4 billion kw.-hr., so close as to make no matter, the highest output of record. The output for 1946 topped that of any war year, and apparently 1947, from the way it has started, will leave 1946 far behind.

The situation is not one to which the old saying, "Misery loves company," properly can be applied. It can hardly be said that anyone is really miserable about it. But there are quite a few American utility men who are, shall we say, rather bothered by the narrowing margin between capacity and load and who may find a little solace in the knowledge that their Canadian brothers are also being crowded.

Inviting Deficiency Appropriations

IN ORDER now is a reappraisal of costs and benefits of hydroelectric power development projects by the federal government. Here is an avenue of economy that can be explored resultfully.

Projects approved and authorized at pre-war cost levels certainly can not be built for those sums. In the 1946 report of the Secretary of the Interior is the statement, "Dams may now cost 50 to 80 percent more to construct than they did in 1940." Estimates of construction cost increases for water power plant, published in the 1947 statistical number of ELECTRICAL WORLD, have a median value of 30 percent as the increase—not from 1940, but since the end of the war. This would indicate at least that the trend of costs is still upward.

Considering, further, that government construction often costs more than authorization estimates, it is to be concluded that the "cheap" power promised from federal hydro projects may be pretty expensive.

Countering this conclusion of higher cost will be the contention that with the general rise in price levels, there will be an increase also in the value of the benefits. Electricity provides much of the benefit in any water project. Its price has declined, not increased, since 1940.

This is why a reappraisal of federal hydroelectric proj-

ects is now in order. The bases of estimate have changed. Projects accepted as feasible when authorized or approved may now be entirely impractical. To proceed with them is only to invite requests for heavy deficiency appropriations tomorrow.

Starting Current Rules

MOTOR STARTING CURRENTS have ever been a troublesome problem for the distribution engineer. They are an inherent factor in his design calculations as much as they are a fundamental item for the motor designer. Each could modify his designs to accommodate the needs of the other if circumstances were sufficiently compelling.

Right now circumstances are at or very close to the compelling stage as far as single-phase motors are concerned because the number and variety of household devices driven by small a.c. motors is increasing rapidly. This same public is simultaneously more conscious of the lamp flicker when his or his neighbor's motor goes through its starting cycle.

Electric utilities have literally spent millions to reinforce their secondaries (that were otherwise large enough to carry the sustained loads) to a point where voltage would not be dipped annoyingly at intermittent intervals when the household appliances are started. Meanwhile annual kilowatt-hours have grown to the point where the revenue now supports this investment made earlier solely to relieve a voltage situation. New growth of demand is dictating another round of the same sequences, this time with motors of one-quarter horsepower and up.

A survey of utility company starting rules is reported elsewhere in this issue of ELECTRICAL WORLD. It shows quite wide variation in the values of starting currents "permitted." Actually the highest values of starting current permitted in any of the rules are being used as a guide by the producers of the motors that are attached to the appliances sold over the nation. The motors are an integral part of the composite product.

But it is the motor and not the appliance that occasions the starting dip—the problem is essentially one between utilities and motor manufacturers. Therefore the place to settle the issue of permissible and tolerable motor starting currents is in an industry committee, composed of utility and electrical manufacturers' representatives. There had been an earlier committee of this sort but it reached no agreement. However so much progress was made that many follow its partial conclusions.

That task needs to be resumed and prosecuted. The answer will be found in terms of public interest. Any agreement that costs the consuming and purchasing public more for a stiffened electric distribution system than it saves by having a less expensive motor or vice versa is not as valid an objective or achievement as it should and could be.

WASHINGTON COMMENT

By R. N. LARKIN

FACED with the prospect of restrictive legislation by the 80th Congress, the Interior Department's power planners have campaigned to bulwark the positions of two marketing subsidiaries, the Bonneville and Southwestern Power Administrations. To date, their success has been such that whatever restrictive legislation the 80th Congress might enact this year, Interior probably will still have won the battle.

Most consequential of Interior's counter-offensives resulted, last week, in a new contract between SPA and the Texas Power & Light Co. It puts SPA in business. Under it, T.P.&L.'s resources, including its steam-electric and transmission line capacity, are more or less at SPA's disposal. Thus, the latter, which heretofore had relatively little salable firm power and almost no transmission capacity, now has both. It all could be undone, of course, by Congressional action taking the United States out of the power business, but without a good deal more change in Washington's thinking, it won't be.

The Texas-SPA contract represents a split between the Texas companies and those to the north in Arkansas, Oklahoma, and bordering states. Not a "sell-out" in the ordinary sense of the term, it implies no undying enmity between the two groups. To some extent, however, it does split them, and it faces the northern group with new problems.

The southwestern split was the year's second. The first came some weeks back in the Northwest, when Bonneville and the companies agreed on a joint presentation before Congress of the need for additional federal hydroelectric capacity in the region. This again was no "sell-out," but it put one industry group in the position of advocating a course which much of the industry has been opposing for years. It undoubtedly won't rend the industry asunder, but it certainly does not build any solidarity in an industry long known for its lack of unity.

At this juncture, Interior can sit back and relax while it watches whatever attempts the industry may make toward legislation in this session of Congress. If the argument against funds for BPA be economy, Interior can point to industry testimony favoring the expenditures. If it be to abolish SPA, Interior can point to the existence of a contract permitting the government to use private facilities. If the move be to authorize private investment in power facilities at federal dams, a la Clark Hill and Bull Shoals, those who oppose it can ask why the Northwestern companies didn't turn up with this suggestion instead of a plea for additional federal investment. The last may not be a completely logical argument, but in Congress it could be effective.

Five-Mile Oilostatic Cable Installation in Atlanta...I*

R. O. LOOMIS • Special Engineer, Georgia Power Co., and
PAUL B. BOYD • Underground Distribution Engineer, Georgia Power Co.

FROM 1941 TO 1944 the demand on the Atlanta 19-kv. system increased from 112,800 kw. to 140,700 kw. or 24.7 percent. Correspondingly the annual kw.-hr. increased from 552.7 to 704.7 millions or 27.5 percent. Knowledge of the system and analysis of where these increases occurred indicated that solutions to four related problems would have to be found as follows:

1. Additional 110/19-kv. transformer capacity.
2. Additional 19-kv. cable capacity into the downtown underground area.
3. Additional 19/4-kv. transformer capacity at Walton Street substation, additional 4-kv. network feeder capacity and additional 4,000-120/208-volt transformer capacity.
4. Elimination of as many oil circuit breakers as possible at Walton Street. Removal of cables from Grady substation into Walton Street was equally desirable.

Briefly, these ends were achieved by installation of 5-mile run of 110-kv. Oilostatic cable between Grady and Boulevard substations as a less expensive alternative to some 17 miles of overhead 110-kv. line around the fringes of the city. Decision for a tie between these two points as the primary means of attaining the objectives was based on a series of a.c. calculating board studies directed at achieving maximum efficacy out of such rearrangement and additions as could be made.

Cable Cheaper Than Line

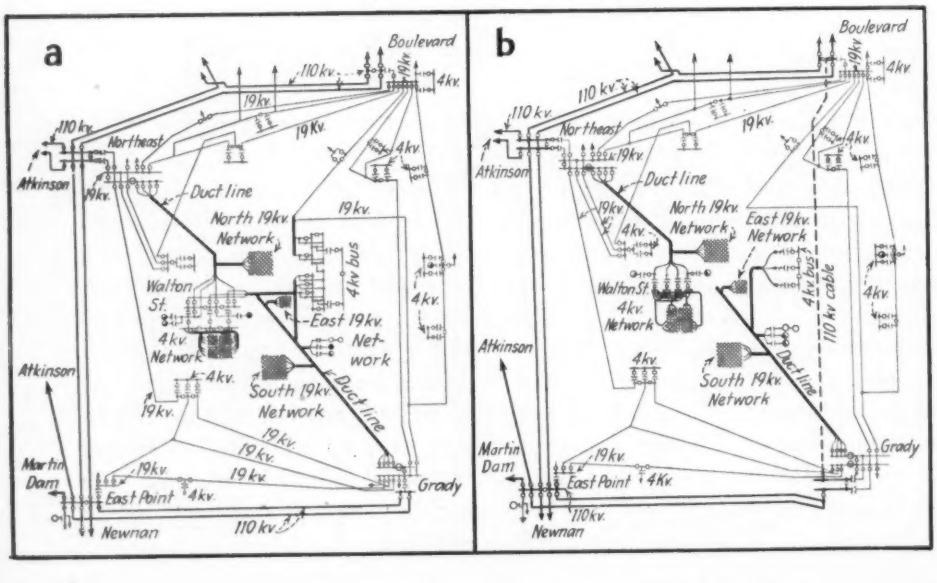
The primary difficulty was the location of the additional 110-kv. lines to supply Grady substation. The shortest route between the Boulevard and Grady substations (Fig. 1b) is through the city where no space is available for locating a 110-kv. overhead line. All schemes studied involving additional 19-kv. cables cost too much per kva. of capacity obtained. Accordingly, a more intensive study was made of the 110-kv. connection between Boulevard and Grady substations. The most direct route between the stations, along city streets, is 4.91 miles. A preliminary survey showed that an overhead route around the outskirts of the city would be a minimum of 17 miles long. A capacity of at least 72,000 kva. is required for the proposed line, since Grady substation would have at least two 36,000-kva. transformer banks.

Cost estimates showed that a 110-kv. underground cable 4.91 miles long of 75,000-kva. capacity would cost less than a double circuit overhead line 17 miles long of this capacity, and about the same as a single circuit line. Consideration was also given to terminating the north end of the line at Norcross substation, approximately 15 miles north of Boulevard substation. Another possibility was a combination 110-kv. line and underground cable direct from Plant Atkinson to Grady substation.

Kvar Credit

The 110-kv. cable, because of the proximity of its conductors, has approximately 6,500 kva. more reactive generation than an overhead line. The system needed this capacity and compared to $6.50 per kva. for static capacitors, represented a credit of $42,000 toward the cost of the cable.

Fig. 1—Reinforcement of 110-kv. system in Atlanta area was accomplished most advantageously by an Oilostatic cable installation between Boulevard and Grady substations. Provision of added load-carrying ability is being effected by changing (a) the former 110- and 19-kv. network to the arrangement shown in (b). This involves the 5 miles of cable shown at the right in (b)



*Adapted from papers presented at recent meeting of engineering and operation section of Southeastern Electric Exchange in Atlanta.

Growth of city load necessitates reinforcement of system—Oil-filled pipe-type cable better than overhead line circling outskirts—Details of cable and pipe fabrication

Network analyzer studies narrowed to four feasible lines and the focus thereafter was upon the choice among them. Both the 110-kv. and 19-kv. overhead systems were explored inasmuch as the latter functions as a network and the amount of load carried over any section depends upon relative phase angles rather than the mere configuration. The accompanying tabulation shows the consequences of each scheme.

The Boulevard-Grady 110-kv. cable was chosen as the most advantageous for the outlay entailed. It permits the additional transformer bank at Grady substation to contribute all the transformer capacity necessitated by No. 1 of the requirements previously enumerated. All the other requirements are being met by correlative measures.

Oil-Pipe System

The oil-filled pipe-type cable system consists, in brief, of three single-conductor impregnated paper insulated shielded cables installed in a welded steel pipe, terminating at the substations in single conductor cable terminals. The cable system is rated to carry 75,000 kva., 3 phase at 85 percent load factor.

Contract for the material, equipment, and supervisory service for the 110-kv. oil-filled pipe-type cable system was awarded to the Okonite-Callender Cable Co. The system furnished by them is known as the Bennett Oilostatic Transmission System. It was installed by the underground construction forces of the Georgia Power Co.

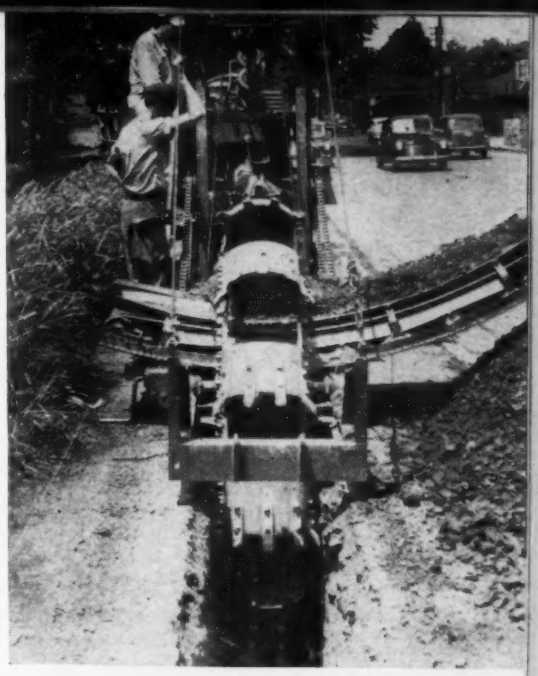
Construction of the parts of the system furnished by the Okonite-Callender Cable Co. is as follows:

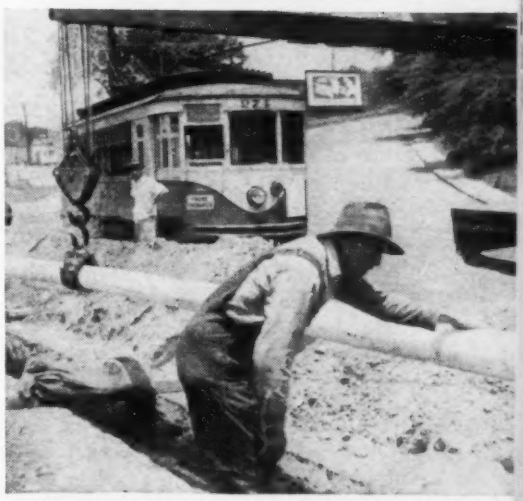
The cable is single conductor 350,000 cir. mil (37 strands) compack round with 0.465-in. wall of impregnated wood pulp paper insulation with three metallized paper tapes wrapped over each copper conductor and included as part of the insulation, one metallized paper tape over insulated conductor, one 0.003-in. copper shielding tape, one layer muslin tape and a D-shaped hard drawn copper wire armor applied in open spiral over the insulated shielded conductor. The D-armor prevents mechanical damage to the cable and reduces the pulling stresses when pulling the cable into the pipe, short circuits each turn of the shielding tape to each other and the pipe, provides space between cables and pipe for better oil circulation, and is contributive to the transfer of heat from the cable to the pipe.

The cable has a 4/64-in. lead sheath covering applied over the core to protect the insulation from exposure until the cable is drawn into the pipe. At that time, the lead sheath is removed. Insulation is composed of two grades of paper, super dense adjacent to the conductor and dense paper. Thickness of insulation, 0.465 in., is the same as for an oil-filled cable manufactured in accordance with the A.E.I.C. Specification, third edition February, 1938, for a 110-kv. system. The conductor size, 350,000 cir. mil, is the size estimated to carry 75,000 kva. at 110-kv., 85 percent load factor with an assumed ambient earth temperature of 25 C. and a maximum copper temperature of 70 C. On the test to breakdown, the cable was tested up to 1,120 volt per mil without breakdown.

The Pipe

The pipe is electric-resistance butt-welded steel pipe $5\frac{9}{16}$-in. O.D. with 0.258-in. wall. It is formed from smooth flat steel plate, so that the inside of the pipe is smooth and free from defects. Chill rings are used in the flared ends to prevent the forma-





TRENCHING MACHINE (Cleveland Model 95) excavating in the sidewalk area. Trenching machine used for excavating for entire length of line except for street crossings (top)

HANDLING PIPE with derrick truck above trench. A leather padded sling prevents damage to the Somastic coating on the pipe

TESTING the Somastic coating on the pipe for breaks in the coating with the Holiday Detector (right)

tion, when the lengths are welded together, of icicle-like formations on the interior. It was furnished in double random lengths, varying in length from 42 ft. to 49½ ft. and was manufactured by Republic Steel Co., Youngstown, Ohio. It was required that the pipe be plugged for shipping, the inside given a coat of Verticol and the outside left uncoated. It was necessary that the pipe be scale-free and clean as well as dry. The pipe was made from grade B open hearth steel, which had the following chemical composition:

Manganese	0.30–0.60
Phosphorus—not over	0.045
Sulphur—not over	0.060
Carbon—not over	0.15

Minimum tensile strength of the pipe was 48,000 psi. and the yield point 30,000 psi. Each length was subjected to a hydrostatic test of approximately 1,100 psi.

The pipe was coated with "Somastic" for corrosion protection. Somastic is an asphalt-mastic covering for pipe, manufactured and applied by the Industrial Engineering Co.

The nominal thickness of the Somastic coating on the $5\frac{9}{16}$-in. pipe was ½ in. and the minimum thickness was ⅜ in. The Somastic coating was applied to the pipe in Carthage, Tex. The pipe was shipped in gondola type cars to Atlanta, stacked six high. Straw was spread on the bottom of the car to prevent damage to the Somastic coating in transit. The coating was tested before installing the pipe in the ground in Atlanta by means of a Holiday Detector utilizing a potential of 45,000 volts with a $1\frac{3}{8}$-in. spark at the detector ring. A very small number of pipes had to have the coating repaired due to damage in transit.

Cable Joints

Cable joints are all semi-stop joints. A bulkhead (micarta manifold) is located at end of the joint through which the cables are installed through glands (stuffing box construction). The reducers (section of joint reducing the joint sleeve to the diameter of the pipe) are welded onto the $5\frac{9}{16}$-in. pipe. The two reducers are held in position and a definite distance apart (42 in.) by three tie rods. The joint sleeve uses Dresser Couplings and is made in two halves. The copper connectors in the joint are compression type. The Burndy foot-operated Hypress is used to compress the connector. A ¾-in. pipe connects the $5\frac{9}{16}$-in. pipes on each side of the semi-stop joint, a tap is made from this bypass into the joint sleeve. Gate valves at the connection to the $5\frac{9}{16}$-in. pipe allow the line to be sectionalized, to locate leaks in the system if they should develop, and allow the line to be filled with oil before the cable joints are constructed and to remain filled with oil during the period in which they are constructed.

The complete pumping plant is housed in one cabinet. The pumping plant is made up of two pumping units, either of which or both may be used simultaneously. Each pumping unit consists of one screw type pump (2½ gal. per minute capacity) with mercoid pressure control relays, one mercoid magnetic relief valve, and one cash relief valve (safety valve). Gages on the cabinet indicate number of gallons of oil in oil reservoir, oil pressure in pounds in pipe line, and nitrogen pressure in pounds above oil in oil reservoir (positive pressure). A recording chart gives the oil pressure in pounds in the pipe line over a seven-day period. An alarm and indicating lights show low oil level in reservoir, high oil level in reservoir, low nitrogen pressure, high nitrogen pressure, low oil pressure in pipe line and high oil pressure.

Cable Terminals

Cable terminals are 161-kv. potheads manufactured by the Ohio Brass Co. The pothead has two porcelains, giving two distinct oil chambers, the inner chamber containing the cable has the oil under the same pressure as in the pipe—approximately 200 lb. The oil between the inner and outer porcelains is at atmospheric pressure. The cable terminals are similar to the cable terminals installed in the Oilostatic Cable Systems at Burlington, N. J., and Baltimore, Md., thus making spare potheads on the three installed systems all interchangeable. A check plate is placed between the pothead and the pothead base plate. The major function of the check plate is to prevent loss of oil in the high pressure chamber of the pothead due to a leak in the system. The cable would continue to operate without pressure on oil for that matter for a considerable period, but if the oil level were lowered in the pothead, it would cause a vacuum and could flash to ground.

The oil reservoir has a capacity of 1,200 gal. Actually, a tank of 800 gal. would be sufficient to take care of the oil expansion in the pipe line, but the larger capacity tank was furnished as this tank was used to fill each section of the line. Nitrogen pressure is used over the oil in the reservoir. The nitrogen pressure is in the neighborhood of 1 to 2 lb. positive pressure.

Details of the installation procedure will be presented in the ensuing instalment.

TABLE 1—Comparison Between Effectiveness of 4 Different 110-KV Connections to Grady Substation

ALL LINES IN SERVICE

Connection	KVA Load Picked up by New Connection	KVA Load on Grady O'head Bank	Load on Boulevard 110–19 Kv Bank		Grady 110 kv. Voltage In Percent of Plant Atkinson
			Kva	Percent	
None	0	0	38,600	107	93.4%
Boulevard Cable	33,700	25,500	30,700	85	97.0%
Boulevard Line	22,900	25,100	31,600	88	96.0%
Norcross Line	20,800	25,200	32,000	88	95.5%
Atkinson Line and Cable	40,600	24,100	32,600	91	98.0%

EAST POINT-GRADY 110 KV LINES OUT

Boulevard Cable	52,300	24,200	30,700	85	95.8%
Boulevard Line	47,800	17,100	33,600	93	92.7%
Norcross Line	42,600	14,500	35,800	99	91.7%

AMOUNT BY WHICH 110 KV BUS VOLTAGES ARE BELOW PLANT ATKINSON VOLTAGE IN PERCENT — ALL LINES IN SERVICE

	Northwest	East Point	Grady	Boulevard	Newnan
None	1.20%	2.22%	5.55%	0.65%	2.78%
Boulevard Cable	1.39	0.92	2.95	1.39	1.39
Boulevard Line	1.67	1.67	4.17	1.67	2.22
Norcross Line	2.03	1.57	4.61	1.57	2.03
Atkinson Line and Cable	1.56	1.01	2.02	1.01	2.02

OXYGEN INJECTION as well as air and steam flow resulted in production of limited quantities of fuel gas of 55, 150 and 222 Btu. per cu. ft. heating value

VERTICAL PIPES sunk through overburden to top of coal seam provide for insertion of thermocouples, taking gas samples and making pressure measurements

Gorgas Coal Gasification Provides Basic Data

Underground combustion in isolated portion of coal seam has been controlled to produce acceptable fuel gas. Cooperative experiment by Alabama Power Co. and U. S. Bureau of Mines accomplishes results within limited field conditions

OFFICIALS of U. S. Bureau of Mines and Alabama Power Co. have concluded that sufficient information has been gained from the experiment in underground gasification of coal at Gorgas to permit quenching the fire and cooling the burned-out area. When this is accomplished, entry will be made to the burned area for observation. Engineers feel it is important to obtain information as to effect of high temperatures on overlying rock strata. As far as is known, this is the first time in the history of underground gasification, heretofore confined to Russia and Belgium, where opportunity for observation has been feasible.

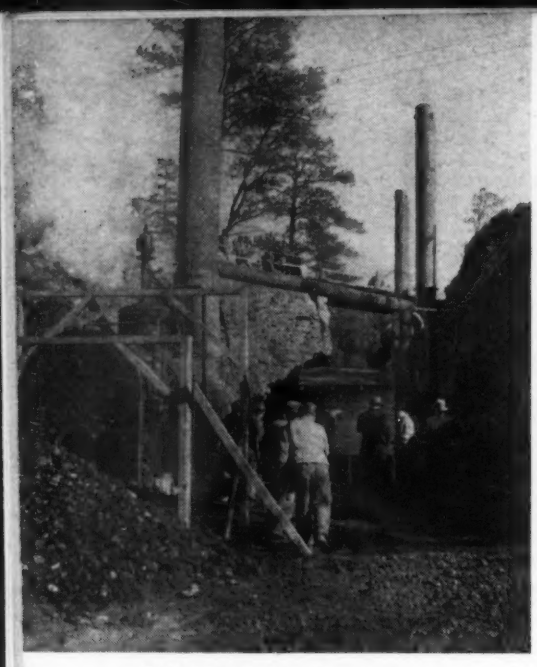
Underground gasification at Gorgas Mine has been under way since January 21, 1947. Combustion has been maintained in a completely satisfactory manner, and gas of varying quality produced, dependent upon use of steam, oxygen, and air. Control over burning coal in the earth has been maintained. It is the first such investigation undertaken in the United States.

Company officials and Bureau of Mines engineers believe the process may open a way to profitable use of impure coal and seams too thin to mine, as well as allow a more nearly complete recovery of coal than present mining methods. As now equipped, the "pilot plant" consists fundamentally of a U-shaped duct in a coal seam through which air and steam are blown to produce combustible gas.

Two major considerations led to selection of the small coal vein at Gorgas as the site at which sustained, controlled underground gasification would be tried. For one thing, it was essential that the experiment be conducted in a vein easily and safely isolated from the main coal deposit. Likewise it was necessary to choose a vein with relatively shallow overburden which could be conveniently stripped at the end of the work.

In choosing the site which satisfied these considerations a disadvantage had to be incurred—the light 30-ft. overburden was subject to burn-outs limiting air input to around 1,400 cu. ft. per min. at 1.5-psi. gage. This limitation, in turn, has kept the equilibrium temperature, during air blasting, to approximately 1,250 F., with the result that heat content of gas during air-blast operations has been held to a range of 50 to 80 Btu. per cu. ft. Inability to maintain desired higher temperatures has also been reflected in relatively low heating values of gas produced in runs of the water-gas type.

Despite these handicaps it is expected that the work at Gorgas, or later efforts at some other location, will yield valuable information on operating problems, types and quantities of useful products and costs of operation. The Gorgas project is regarded primarily as a fact-finding experiment, intended to deter-



COAL SEAM, three-foot vein, cut to localize combustion zone, with two 40-ft. exhaust stacks, air blower (in wooden shed), steam boiler and piping installation

mine the practicability, in this country, of a process which has already been applied commercially in Russia and will be tried soon in abandoned mines in Belgium. Russian plans call for underground gasification at the rate of about 100 million cu. ft. per day by 1950. Currently, the chief interest in the work in Alabama is the study of engineering problems and the completeness of conversion of the coal.

From the ultimate viewpoint, the investigation is regarded as important for the light it is expected to throw on the use of underground gasification as a means of producing gas for boilers, gas turbines and manufacture of synthetic fuels and lubricants and other chemicals. It is thought unlikely, however, that the Gorgas project will be more than a preliminary effort leading the way to later development.

Various difficulties, most of them expected, have been encountered in operation. As stated above, the lightness of the 30-ft. overburden has not permitted pressure of steam or air in the burning bed to be increased much over 1.5 psi. Even with this low pressure, burn-outs have occurred, necessitating application of bags of clay and Gunnite around the seam, thereby closing the apertures used for observing progress of combustion. In March, Gunnite had been applied to a thickness of 4 in. around the overburden. Engineers do not believe that burn-outs will be a serious obstacle if the operation is applied to more heavily covered seams.

The Alabama Power Co., operator of extensive coal property in the Gorgas region, is interested in means of developing cheap fuel for its 200,000-kw. steam power plant ¾ mi. from Gorgas. The company is also planning construction of a 240,000-kw. plant near Gadsen, Ala. In view of its direct interest in developing low-cost fuel, the company has undertaken the work at Gorgas in cooperation with the Bureau of Mines of the Department of the Interior and also the Southern Research Institute. These two agencies have been contributing technological and operating assistance and the company has been financing the venture as well as furnishing personnel.

The seam selected for the Gorgas experiment is a small peninsular strip cut off from the main bed. Through this horizontal, 36-in. vein was cut a U-shaped combustion duct, consisting of one entry 140 ft. long, another 170 ft. long, and a 40-ft. crosscut. The cross-sectional dimensions of the duct were 6 ft. (width) by 3 ft. (height). Bags of clay placed internally along walls of the entries for the greater part of their length reduced the tendency of burn-outs to break through.

Air and Steam Supply

Sealed by a concrete stopping into the opening of each entry is a 24-in. pipe from the air blower, a 2-in. steam line and a 24-in. pipe leading to an exhaust stack approximately 40 ft. high. As indicated in the sketch, a simplified plan view of the installation, the piping arrangement is such that air or steam may be injected into either of the two entries, with combustion gas leaving through the stack at the opposite leg of the duct. Provision was made for this alternate type of flow in order to minimize unequal consumption of coal.

Combustion was started by dropping incendiary bombs through 4-in. pipes sunk vertically through the overburden and adjusted to permit bombs to fall upon broken coal placed in the crosscut. Originally, progress of combustion could be observed through Pyrex glass vision slots set in eight adits, 6 ft. wide and 3 ft. high, excavated at 25-ft. intervals along the entries. Because of burn-outs, the adits have all been closed with bags of clay and a covering of Gunnite laid over the bags.

Provisions were made to determine differences in pressure, temperature and composition of gas at various points. Through the overburden, 16 pipes of 4-in. diameter were sunk vertically to the top of the seam and capped, with connections through the caps for insertion of thermocouples to the seam and for taking gas samples and pressure measurements. Later, four additional pipes were inserted as combustion began to spread and as some of the original pipes and thermocouples became damaged near the seam. Also, somewhat similar connections were installed at the eight adits along the entries. In addition, temperatures, pressures and gas samples can be taken at the points where gas enters the stacks.

Temperature Too Low

Spot temperatures in the combustion area, during air blasts, have reached 2,000 to 2,200 F. The average, however, has ranged between 1,300 and 1,500 F. Higher temperatures have been hard to attain because the resistance to gas movement in the duct resulting from roof falls and undetermined causes has prevented a rate of air input sufficient to produce desired temperatures.

Several types of operation have been carried out at Gorgas, principally continuous air blasting to manufacture producer-type gas and alternate runs with air and steam for production of water gas. A short period of oxygen injection was also tried. In view of the present brief span of the experiment, and because of operating difficulties believed ultimately susceptible of solution, officials do not wish at this time to express final conclusions on the work beyond saying that it is a promising start and justifies further research.

Officials who have followed the work at Gorgas have released a small amount of data to indicate the character of the make gas. They emphasize, however, the limitation on air input and its injurious effect upon the quality of gas produced.

An example of quality of gas produced during an air blast run, during which production was estimated at the rate of 1,400 cu. ft. per. min., is:

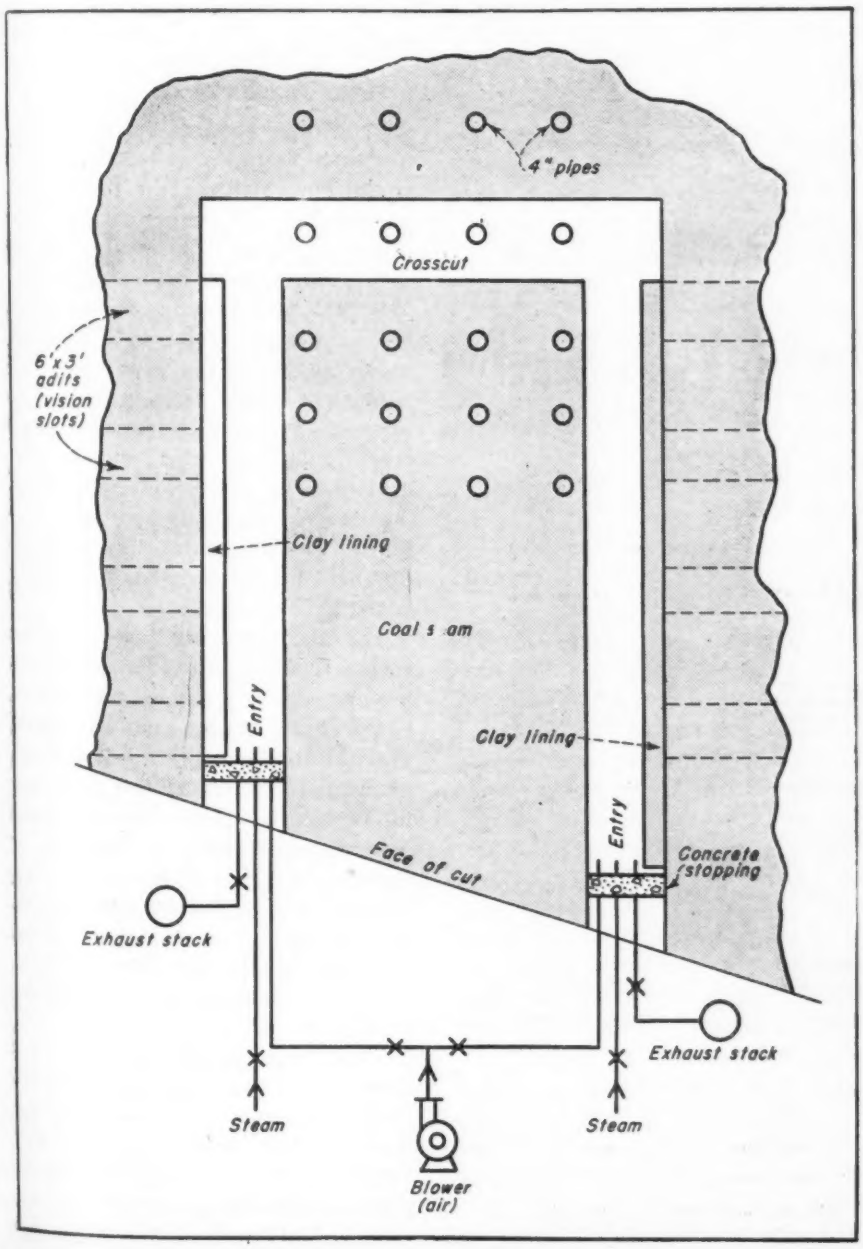
	Vol. Percent	Btu. per Cu. Ft.
Carbon dioxide	16.2	
Oxygen	0.4	
Illuminants	0.2	
Hydrogen	7.4	
Carbon monoxide	4.2	
Methane	1.4	
Nitrogen	70.2	
Total	100.0	55

INCENDIARY BOMBS for lighting off in hands of M. H. Fies, Alabama Power Co., W. C. Schroeder, L. D. Schmidt, Arthur Sands and J. L. Elder, U. S. Bureau of Mines . . . Fire started in broken coal placed in crosscut by incendiaries dropped through 4-in. vertical pipes. Progress of combustion was observed through horizontal adits

An indication of the quality of water gas production is seen in the following analysis of a sample make gas produced during a steam run of about two hours. It was estimated that, during this steam run, gas production averaged about 220 cu. ft. per min.

	Vol. Percent	Btu. per Cu. Ft.
Carbon dioxide	26.0	
Oxygen	1.0	
Illuminants	0.4	
Hydrogen	34.4	
Carbon monoxide	19.2	
Methane	4.3	
Nitrogen	14.7	
Total	100.0	222

U-SHAPED combustion duct cut through small peninsular strip of coal vein with 170-ft. and 140-ft. entries, 40-ft. crosscut arranged for reversing flow



A supply of liquid oxygen was brought to Gorgas with the intention of securing greater intensity of combustion. However, the nature of equipment available for vaporizing the oxygen limited oxygen input to about 200 cu. ft. per min. This rate was too low for best results, being actually less than the oxygen input included in the maximum practicable air-blast rate of about 1,400 cu. ft. per min. In a three-hour run during which a mixture of 40 percent steam and 60 percent oxygen was passed through the duct, make gas at an estimated rate of 1,000 cu. ft. per min. was obtained:

	Vol. Percent	Btu. per Cu. Ft.
Carbon dioxide	55.4	
Oxygen	1.4	
Illuminants	0.2	
Hydrogen	18.8	
Carbon monoxide	12.6	
Methane	4.6	
Nitrogen	7.0	
Total	100.0	150

Of much interest is the effect on the coal and the overburden. After the burned section has been steamed for several days and quenched with water, the overburden will be removed and the entire area closely examined.

M. H. Fies, Alabama Power Co., and H. M. Johnstone, Gorgas Coal Mines, have coordinated operations.

Limits of Accuracy Set for Wire and Cable Testing

Acceptable Limits of Accuracy — Commercial Wire and Cable Testing

Type of Testing Equipment	Range of Application *	Acceptable Accuracy Limits
A. Proof-Voltage Test Equipment		
Overall check of voltage at test-bus at no-load and with load	Range certified	±4%
Crest-factor (maximum acceptable deviation from 1.414)	Voltage range certifiable	±5%
B. Insulation Resistance Test Equipment		
Shunt and calibrating resistors of series galvanometer sets	———	±1%
Overall performance in resistance measurement	0.1 to 20,000 megohms	±10%
C. Conductor Resistance Test Equipment		
Wheatstone bridges:— Ratio and rheostat coils	———	±0.2%
— Overall performance, for rheostat setting above 300 ohms	1 to 1,000 ohms	±0.3%
Kelvin bridges	0.001 to 25 ohms	±0.5%
D. Conductivity Test Equipment		
Hoopes bridge, using copper standards	Wire sizes 4/0 to No. 21	±0.2%
Balance and weights for weight deviation	Wire sizes 4/0 to No. 21	±0.1%
Gauge for preparing specimens	Wire sizes 4/0 to No. 21	±0.1%
E. Capacitance and Power Factor Bridges		
a. 1,000-Cycle Capacitance Bridges		
Capacitance measurements:—		
Fixed ratio types	100 mmf to 1 mf	±0.3% or 2 mmf times bridge ratio (a)
Slide-wire ratio type	0.01 mf to 0.5 mf	±2%
Capacitance unbalance	———	±20 mmf or 2% (a)
Power factor	0 to 0.1	±0.001 or 2% (a)
b. 60-Cycle Bridges		
Capacitance measurements	Full range	±1%
Power factor	0 to 0.1	±0.0005 or 2% (a)
c. Frequency of oscillators	1,000 to 20,000 cps	±5%
F. Impedance Bridges		
a. 1,000-Cycle Bridges		
Inductance, Capacitance, AC Resistance, Dissipation Factor, Slide-wire ratio type	Range certified	±3%
G. Tensile and Compression Test Equipment		
Type I tensile-test machine	Range certified	±1%
Type II tensile-test machine	Range certified	±2%
Compression testers	Range certified	±1% full scale
Proving rings	———	±0.2%
H. Direct-Reading Scales and Balances		
Direct reading scales	Range certified	±0.1% scale range (b)
Balances, equality of arms	———	±0.1%
I. Thermometers — Direct Reading	0 to 300 F	±1 F
Recording Types	0 to 300 F	±2 F
J. Micrometers and Pin Guages — All types	0 to 500 mils	±0.2 mil
K. Weights (General Use)	———	±0.1%
L. Voltmeters — Portable, for general use	Range certified	±0.5% full scale (c)
Electrostatic	Range certified	±2% full scale (d)
M. Timers — For insulation testing	1 to 15 min.	±2% or 2 sec. (a)
N. Penetrometers	———	**
O. Sparkers — Electrostatic voltmeter check	To 20 kv.	±10%

* A device will not be certified over that part of its range where the probable minimum error of observation is greater than one-half the acceptable accuracy limit.

** Construction and use in general agreement with the essential requirements of ASTM Standard D5–25.

(a) Whichever is larger.
(b) But not larger than 1% of indication.
(c) But not larger than 1.5% of indication.
(d) But not larger than 5% of indication.

GORDON THOMPSON,
Chief Engineer
Electrical Testing Laboratories, Inc.
New York

WHEN LARGE QUANTITIES of wire or when cable representing a considerable investment is to be examined for acceptance, both manufacturer and purchaser welcome a standardization procedure, carried out by some institution acknowledged by both parties to be responsible, as offering a method of removing any questions as to the reliability of the equipment employed for the acceptance testing. A further step in this direction would call for the use of some readily visible evidence of satisfactory accuracy so that it would not be necessary to refer to a detailed report to learn if a given piece of equipment might be used with confidence. Such a certification seal or label would be granted and affixed to a piece of equipment on the basis of measured conformity to accuracy limits for acceptable performance that have been declared and acknowledged by both parties.

The accompanying table presents such a series of limits for acceptable performance for a considerable variety of equipment and standards used in the final witness-testing of wires and cables at the manufacturers' plants. These values represent those currently in force in a regime set up by Electrical Testing Laboratories, Inc. in cooperation with some 20 or more cable manufacturers scattered across the United States from the Atlantic Coast to the Pacific Coast.

These listed limits have been arrived at through numerous conferences and have been revised from time to time during the past five years as operating experience indicated needed changes.

Over-all accuracy with which a cer-

tain measurement or test can be carried out while using an assembly of testing equipment depends, in the first place, upon the accuracy of the instrument which is directly indicating the testing stress. It depends, in the second place, on the inherent accuracies or on the probable accuracies of the several components of that testing equipment. And then, in the last place, the over-all accuracy which can be expected is limited by the care with which the man who is running the test sets the indicating instrument to the test stress which the specifications require.

The limiting values given in the foregoing table have been fixed with the intention that the factory test operator shall set his equipment to give the specification stress and then the standardizing agency will determine what stress has been produced. Such a method of calibration includes, therefore, all three of the elements enumerated above.

Wherever standards of performance have been set up by national standardizing bodies, as for example in the case of the American Institute of Electrical Engineers' Standard No. 4, "Measurement of Test Voltages in Dielectric Tests", and in American Society for Testing Materials' Method E4-36, "Verification of Testing Machines", the limits there set have been used or have been allowed to exercise a major influence in setting the limits in the table.

Vacuum Impregnation of Cables and Capacitors

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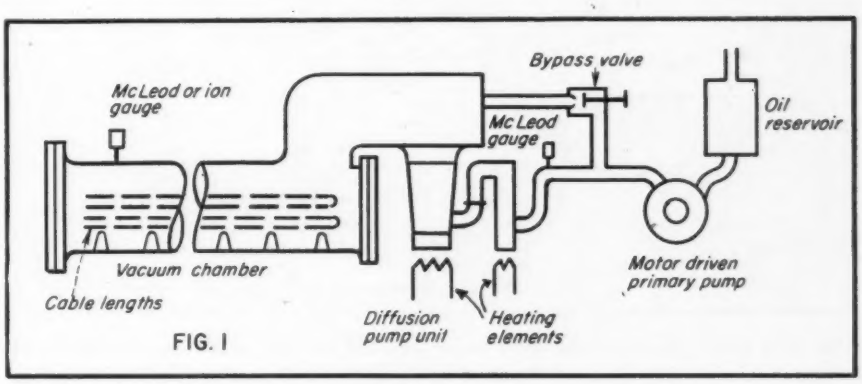
Engineer, Industrial Division
Stone & Webster Engineering Corp.
Boston

Twenty-hour process for vacuum impregnation of paper-insulated cables and capacitors boosts service life. Equipment and procedure described

LENGTHS OF TRANSMISSION and distribution cables of the paper-insulated, liquid-impregnated type designed to operate at potentials of 2.3 kv. and above may be effectively treated for increased life by being subjected to pressures as low as 0.01-mm. mercury, with resultant removal of air from the smallest bubble, and the space formerly occupied by the entrained air refilled with an insulating compound. Paper-insulated capacitors may likewise be subjected to equally low pressures, and high dielectric materials, heated to fluidity, used to replace the entrained air in the paper insulation between the successive layers.



EQUIPMENT ARRANGEMENT for cable impregnation

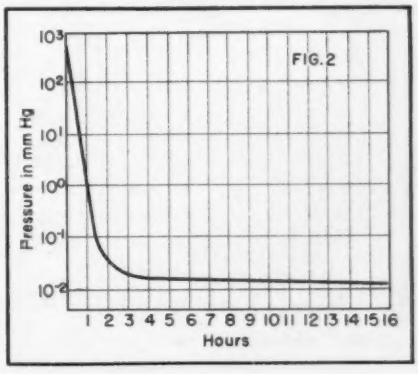
Equipment Used

The equipment for such treating is simple, consisting of a long cylindrical vacuum chamber and usually a diffusion pump unit connected in series with a primary pump. The electrical energy requirement for such a system remains fairly constant throughout the range of vacuum produced. A typical low-pressure unit would require 15 hp. to drive a 300-cfm. primary pump and from 2 to 3 kw. to supply heat to a diffusion pump of 5,000-liters per sec. capacity.

The heat applied to the underside of the diffusion pump causes the pump fluid, usually mercury or oil, to boil, and the hot vapors, directed upward by chimneys, are discharged through two or more circular nozzles toward water-cooled condensing surfaces. The vapors of the pump fluid intermingle with the gases from the vacuum chamber and are then carried with the condensed oil downward toward the pump's exhaust.

The treating time for cables or capacitors varies from 1 to 20 hours. Insulating materials will quickly release the major portion of the entrained vapors, and for this reason the pressure must be lowered gradually to prevent rupturing the paper insulation. The remaining entrained vapors are released more slowly. Sometimes a period of two weeks or more is needed to attain nearly complete degasification. In practice, the operator depends on the leveling off of the pressure-time curve to indicate when the entrained air is sufficiently removed. As the pressure is raised within the chamber to atmospheric, the compound selected to fill the voids is forced into the smallest interstices of the insulation.

CURVE SHOWS REDUCTION of pressure as entrained air in insulation is removed by high vacuum treatment



Planning a Rural System

Progressive evolution from a 300-kva. system with 112 miles of 12-kv. line serving 203 members to 7,500-kva. serving 5,600 from 5 substations fed by some 60 miles of 69-kv. line

C. MAXWELL STANLEY
Stanley Engineering Co.,
Muscatine, Iowa

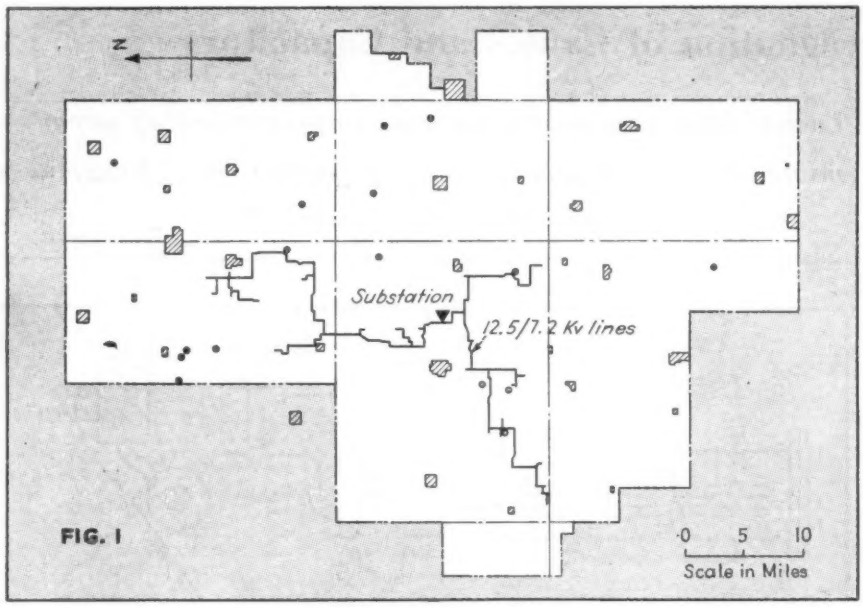


FIG. 1

IN 1936 Clarke Electric Cooperative began with 203 members, a 300-kva. substation and 112 miles of 12.5/7.2-kv. lines

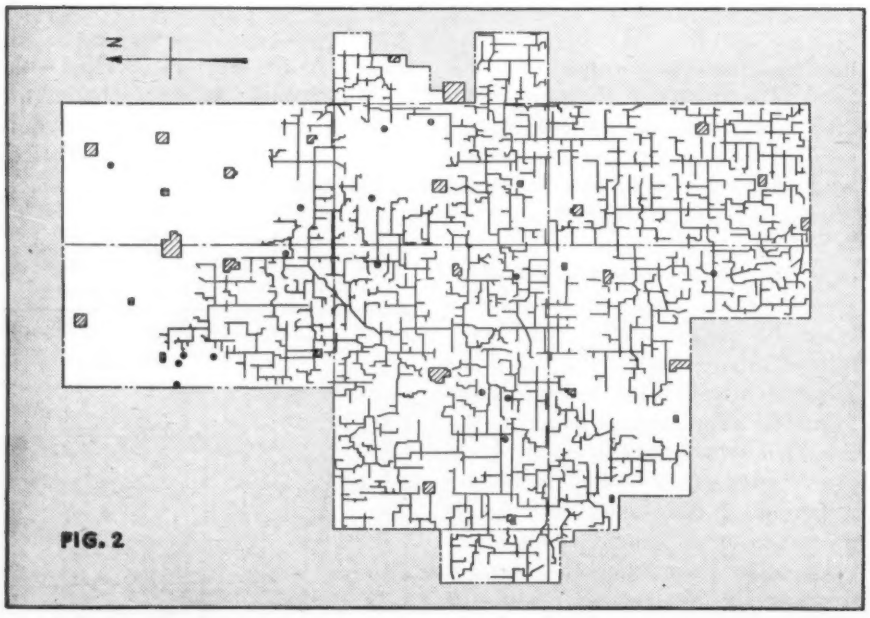


FIG. 2

LINES NEEDED by the cooperative to provide area coverage (5600 members) and serve expected average demands of 1.2 kw. per customer

IN NINE YEARS (June 30, 1936 to June 30, 1945) the number of rural electric customers served in Iowa increased from 24,700 to 124,900, a five-fold change. Of these utilities are serving 49,800 and rural cooperatives 69,632. Among the larger cooperatives is the Clarke Electric Cooperative, Inc., which started with a 112-mile line to serve 203 members and a fond hope that average consumption of 100 kw.-hr. per month would ultimately be achieved. Not only has this estimate been upped to 350 kw.-hr. per month (with demands of 1.2 or more kw.) but accompanying the steady increase in utilization there has grown a demand for area coverage and a call for improved service. Thus the Clarke cooperative is expecting a total maximum demand of 6,500 kw. in contrast to the 300 kva. of substation capacity installed ten years ago (Fig. 1).

It may be of interest to review what has been done step by step and what is planned to keep abreast of this typical growth in customers and in use.

Load Prediction

There are three major problems confronting a cooperative under the circumstances outlined; (1) load prediction; (2) system planning; (3) power supply.

There is a fundamental need for better data and information with which to estimate intelligently probable consumptions and demands on rural systems. There is a complete lack of precedent and absence of good information on which to base predictions of load. Better data are needed.

Extensive research and study are needed to provide the following data:

A. Determination of probable saturations that can be obtained with various appliances on the farms.

B. Estimate of consumptions of electrical energy which will result

for Twenty-Five-Fold Growth

from various saturations of appliances and apparatus.

C. Study of maximum demands on individual farms resulting from various consumptions and usages.

D. Study of diversities between individual demands which may be expected on rural systems.

The problem may be approached from the following angles:

A. Statistical study of consumption of individual consumers and groups of consumers.

B. Field measurement and recording of maximum demands on a considerable number of individual farms with a complete tabulation of appliances and apparatus used.

C. Extensive study of uses of electrical energy on various types of farms including analysis of existing and needed appliances and apparatus.

D. Analysis and coordination of the basic data obtained from the three approaches listed above.

System Planning

Area coverage, growth of load, and demand for improved service dictate the necessity for careful system planning. Preparation of a logical plan for the development of a rural system involves the following steps:

1. Determination of boundaries of area to be served.
2. Location of consumers within this area.
3. Location of 12,500/7,200-volt lines to serve these consumers.
4. Division of area into load centers and selection of substation sites.
5. Selection of design load to be used in planning.
6. Determination of total design load for each load center.
7. Design of distribution feeders to provide adequate regulation.
8. Determination of power source.
9. Design of transmission system to deliver energy to load centers.

Fixing the boundaries leads to a plan of required distribution lines similar to that of Fig. 2, from which tabulations of consumers and miles of line may be made.

Division of the area into load centers and the selection of substation sites is the most important step in the system plan. The proper arrangement is that which will give satisfactory service at the minimum annual cost. This step involves all of other ensuing steps and can usually be accomplished only after comprehensive economic comparisons of various plans. The decision is influenced by:

A. Design load per farm.

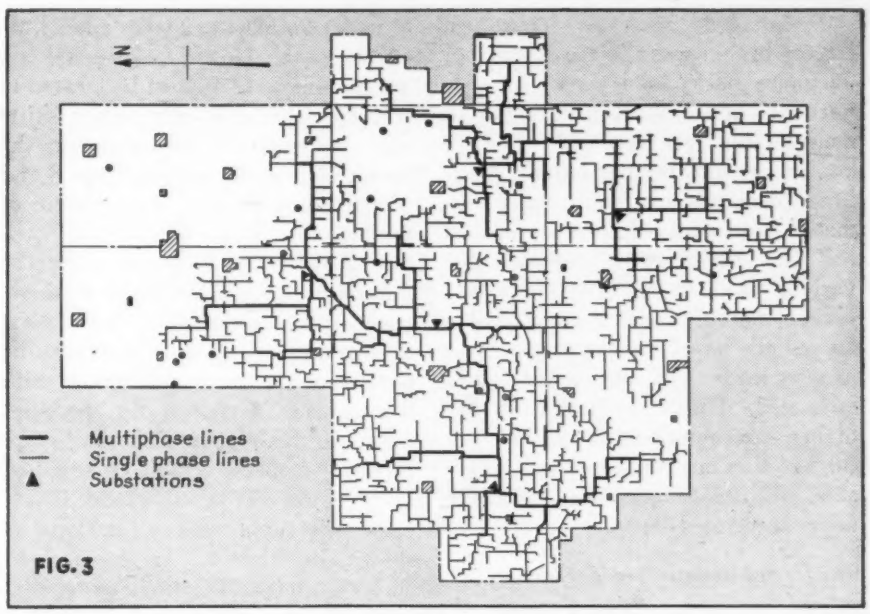


FIG. 3

TO RENDER the area coverage it will be necessary to provide main feeders (heavy lines) and substations (triangles) shown

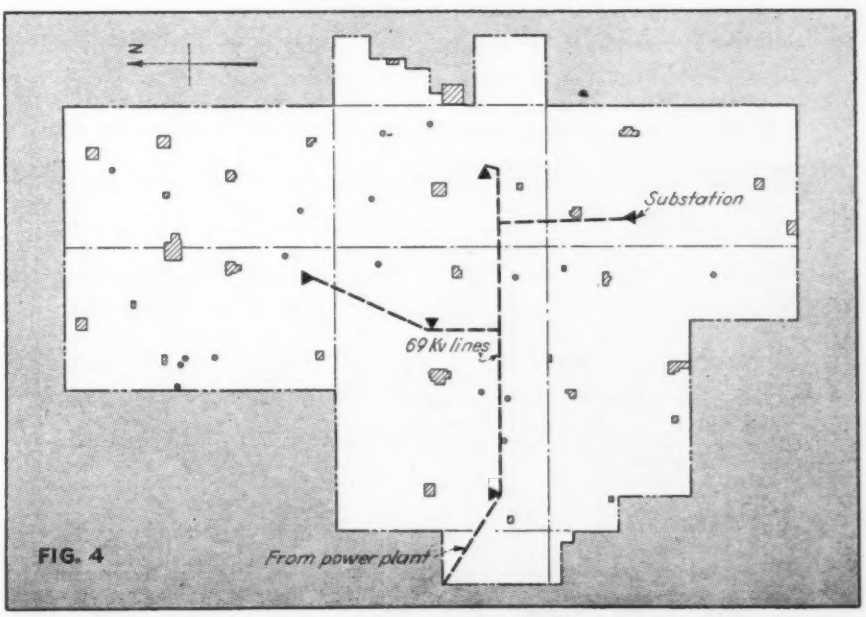


FIG. 4

TO RENDER service to the substations of Fig. 3 these 69-kv. lines are projected

B. Location and size of any concentrated loads.

C. Location and conductor size of existing lines.

D. Topographical features including rivers and lakes.

E. Accessibility to substation sites.

Design Load

In general we have found that load centers serving between 700 and 1,000 members and requiring substation capacities of 1,000 kva. or 1,500 kva. prove to be the most economical. Furthermore we have found that substation sites must usually be selected to fit the distribution requirements rather than to suit the power source.

Design load must be determined largely by judgment in the absence of adequate basic load data. This is normally done by selecting a design consumption of from 325 to 500 kw.-hr. per member per month. Maximum demands are then usually estimated from demand curves prepared by REA giving total demands for various numbers of consumers and various monthly consumptions. These curves are based on experience with present loads, with the higher values estimated. Their accuracy at the higher consumptions is problematical but they are the best data available. Allowance must also be made for concentrated loads.

Substations and Feeders

After area is divided into load centers with substation sites selected and the basis of design load is determined, it is largely a matter of computation to determine substation loads and to design distribution feeders to obtain adequate voltage regulation (Steps 6 and 7). Required voltage regulation may be obtained by:

A. Extension of multiphase feeders.

B. Increase of conductor size on main feeders.

C. Building additional main feeders.

D. Use of voltage regulators.

Fig. 3 shows a system plan for the Clarke Electric Cooperative using five substations. Aggregate demand is estimated at 6,600 kw. with a 350 kw.-hr. per member consumption.

Power Supply

Selection of power source has little effect on the location of 12,500-volt substations as they must be located to suit the load and only minor shifts may be made to accommodate the power source. Therefore, steps 8 and 9 are more or less independent of the planning of the 12,500-volt distribution system. Power may either be purchased or generated at a single point and transmitted to the substation by the Cooperative or it may be purchased at each substation with transmission provided by the supplier. In this typical case, the Clarke Electric Cooperative will be supplied by a power cooperative and 69-kv. lines will supply the substations as shown in Fig. 4. In Iowa both 34.5-kv. and 69-kv. lines are being planned by cooperatives. The 34.5-kv. lines are of pin type construction and the 69-kv. of suspension type construction.

As loads have increased the problem of power supply has become more critical. The magnitude of this problem may be indicated by considering the aggregate potential rural demand in Iowa based upon an average monthly consumer usage of 450 kw.-hr. When 200,000 Iowa farms are provided with electrical service within the next few years, this will mean an aggregate rural demand of over 300,000 kw. In a typical rural Iowa county, without a sizable city, the rural load will likely exceed the urban load. In such a county some 2,000 rural customers will create an aggregate demand of around 3,000 kw. which will exceed the combined demand of a county seat city having a population of perhaps 4,000 together with several outlying smaller communities.

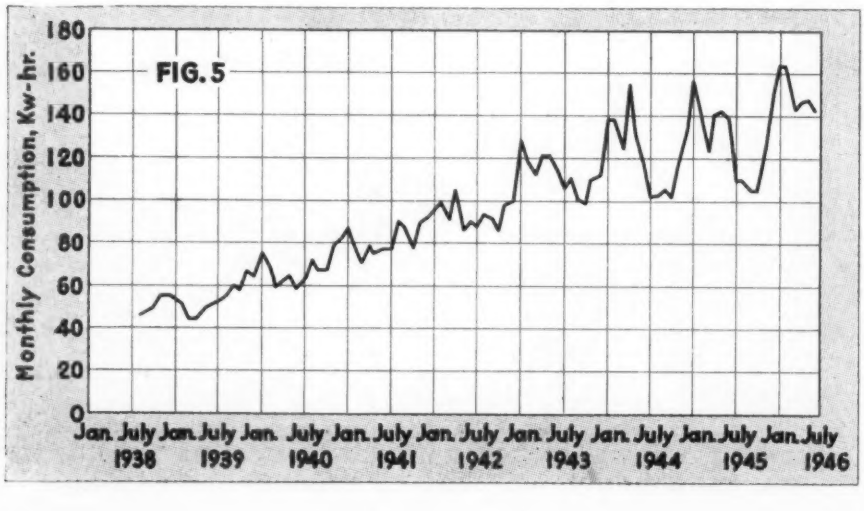
No longer is the rural load a negligible item which can be readily assumed by existing facilities, either utility, cooperative, or municipally owned. Not so when we compare a probable rural demand of 300,000 kw. with a 761,000-kw. installed capacity of generating plants in the state of Iowa, including the large hydroelectric plant on the Mississippi River at Keokuk, part of whose output is transmitted to St. Louis.

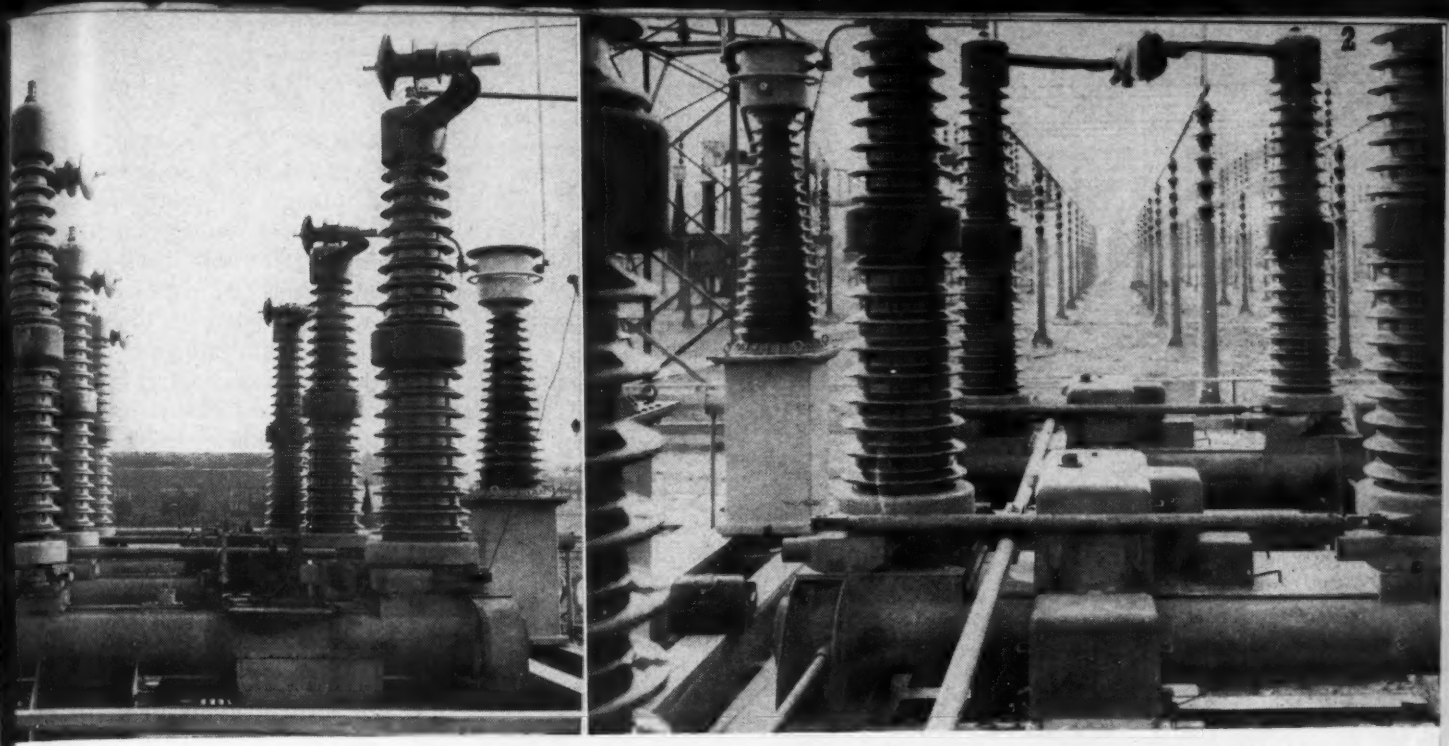
Provision of Capacity

How is this power supply to be provided? In general the increase must be taken care of by new generating capacity, which must be installed either by utilities, cooperatives or municipalities. Very naturally, the utilities will provide such additional capacity as may be necessary to take care of the rural consumers served by themselves, perhaps one-third of the total. The remaining two-thirds of the rural consumers will be served by cooperatives who will either purchase or generate their power requirements.

At the present time all but twelve of the 49 cooperatives in the state are purchasing their entire power requirements from utilities or municipalities. Of these twelve cooperatives one has its own Diesel generating plant which supplies its entire requirements. The other eleven are served by two power cooperatives who upon completion of their present construction program will supply their full requirements. Thus about 75 percent of the cooperative power requirements are purchased from utilities or municipalities at present.

AVERAGE MONTHLY consumption per member of a typical Iowa cooperative (Humboldt) has grown in eight years from about 50 to 150 kw.-hr. per month





GENERAL VIEW of German 220-kv. air-blast breaker (left) with arms and arcing heads swung apart in open circuit position (CT at right not part of breaker) . . . Pneumatic operating mechanism of German breaker (right). Poles are actuated separately, or all together by common mechanism

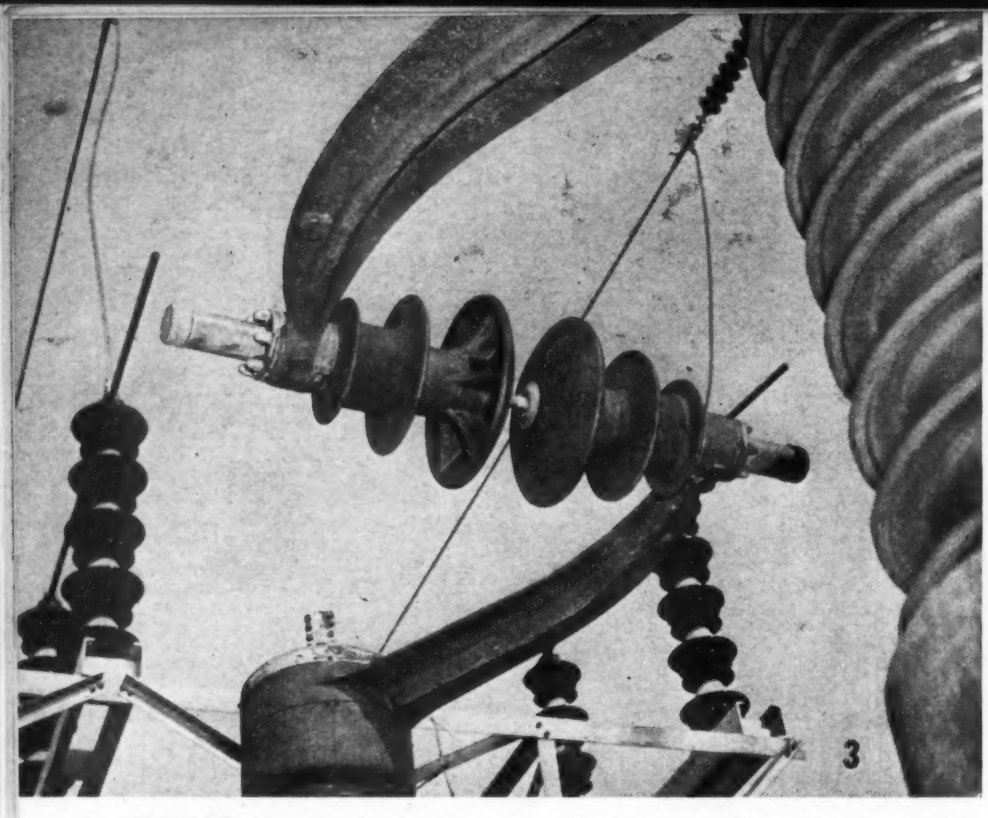
American Ingenuity Can Improve German 220-Kv. Air Breaker

Promise of improved American adaptation of German 220-kv. air-blast breaker inspired by recent field tests at which 2,300,000 kva. were interrupted in 6 cycles—Capable of reclosure faster than deionization but prone to restrike on interruption of line charging currents. Simple as to conductive parts but air-operating mechanism is intricate

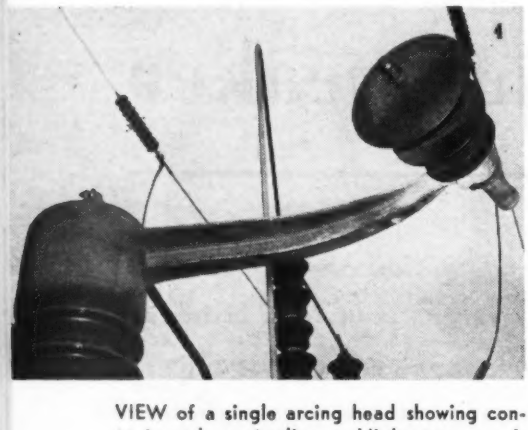
SIX CYCLES of interrupting time on fault currents and an objectionable number of restrikes on line charging current caused the 220-kv. German air-blast circuit breaker under test on the system of the Bonneville Power Administration to fall short of performance of American oil circuit breakers of comparable rating. In other respects the breaker performed most creditably, interrupting 2,300 mva.—the maximum fault current attainable, at breaker's location—with no observable distress.

Tests on this most interesting breaker design, conducted February 22-24, (reported in ELECTRICAL WORLD for March 1, page 43) attracted engineers, oil circuit breaker specialists and operating men from all sections of the country. Purpose of the tests was not only to investigate the interrupting capacity of the breaker, and if satisfactory to copy this design, but in addition to investigate and report on the complicated phenomena of circuit interruption, so that detailed analysis of records and observations made during the tests would give American engineers a solid basis for development along the lines of this design. The full and complete official report of the tests will be issued at a later date by engineers of the Bonneville Power Administration.

Tests were conducted at the J. D. Ross substation of the Bonneville Power Administration at Vancouver, Wash. Some 30 tests were made in all. Phase to ground faults (133 kv.) were created through the test breaker (with back-up breaker) directly on the 230-kv. bus fed by two 230-kv. lines from Grand Coulee and Bonneville power plants; three 115-kv. lines, through step-up transformers, from the Bonneville power plant, and one 230-kv. line from Chehalis, Wash., fed directly from Grand Coulee and the Seattle power plants and indirectly through step-up from 115-kv. lines from the Puget Sound region. Also, local generation of Portland General Electric Co. and Northwestern Electric Co., through



CLOSE-UP view of arcing heads on one pole of breaker. Current is interrupted by retraction of air actuated pistons and blast of air under 280-300-lb. pressure conducted up insulator columns through steatite tubes and out through radial arms to the heads. Breaker arms remain in this position until after a predetermined number of reclosures, after which they are swung apart to the open circuit position (Photo 1)



VIEW of a single arcing head showing contact rod protruding. High-pressure air retracts contacts rapidly; air blast through hole in composition head snuffs out arc

back-up breaker, fed into the bus.

This German breaker was a piece of new equipment shipped to America after the occupation and is the only one in this country. It was turned over by the Department of Commerce to a Task Committee under the chairmanship of Lieut.-Col. Ralph M. Wood, which in turn assigned it to the Bonneville Power Administration to test and report back.

Description of Breaker

The breaker is described as a 220-kv., 2,500-mva. AEG (German), free-stream, air-blast circuit breaker. The breaker is composed of three poles, each pole consisting of two vertical porcelain columns about 10 ft. high and separated by a distance of 8¾ ft., as shown in Fig. 1. Each column has a radial disconnecting arm attached at its top. All columns are linked at the base (Fig. 2) in such a way that rotation of the columns causes the two disconnect arms to swing apart for circuit isolation. Each pole unit is mounted on a steel frame directly above a compressed air tank which is an integral part of the frame, as illustrated. The three compressed air tanks are connected together and to the source of high-pressure air. Normal operating pressure is between 18 and 20 atmospheres (280-300 lb. per sq. in.). An operating piston mounted on the center phase air tank rotates the insulator columns through the linkages shown, thereby providing opening and closing of the disconnect arms.

Perpendicular to each radial disconnect arm and extending horizontally is a retractable interruptor contact mounted in an extinguishing head (Fig. 3.) The arcing contacts (Figs. 4 and 5) are hollow cylindrical rods which protrude about ⅛ in. from the extinguishing heads into free air where they are butted together by spring action (Fig. 5) when in the closed position. High-pressure air is carried through the steatite pipe located inside of rotating porcelain columns and the ducts inside of disconnecting arms to the extinguishing heads where it acts both to separate the contacts and to extinguish the arc. When retracted, the contact faces are shielded by a hard rubber nozzle on the extinguishing head which controls the arc and directs the arc-extinguishing air during interruption. The terminal connections are located at the top of each porcelain column and are connected directly to each disconnect arm by means of a slip joint. To prevent the condensation of water inside of the insulator columns, a small quantity of low-pressure, dry air is circulated continuously in and around the steatite pipes in the column.

Steps in Operation

This breaker may be used for short-circuit interruption, single- or three-phase reclosing, or for full opening. For full opening in which the isolating disconnects operate after arc extinction, the breaker may be tripped electrically or by a pneumatic push-button, thus actuating a full-opening valve which permits air to flow to three blast-control valves, one on each phase of the breaker. These valves permit blast air to flow up the insulator columns and out to the interrupting contacts, retracting them and snuffing out the arc. Meanwhile air has been impressed on a piston-control valve which allows the operating piston to move, thus rotating all three pole units and separating the disconnect arms after the arc is out.

On each phase is mounted a short-circuit trip valve for the purpose of reclosing operations. The trip solenoids of these valves may be connected for single-pole or three-pole reclosing. Upon energization of the trip solenoid, air is permitted to actuate the blast-control valve and retract the interrupting contacts as before. At the same time, air is admitted to a holding piston which keeps the trip valve open even though the tripping impulse is disconnected. Air is also admitted to a pneumatic-time-delay chamber, which, after a delay of about ten cycles neutralizes the air in the holding piston, thus shutting off the trip valve which in turn shuts off

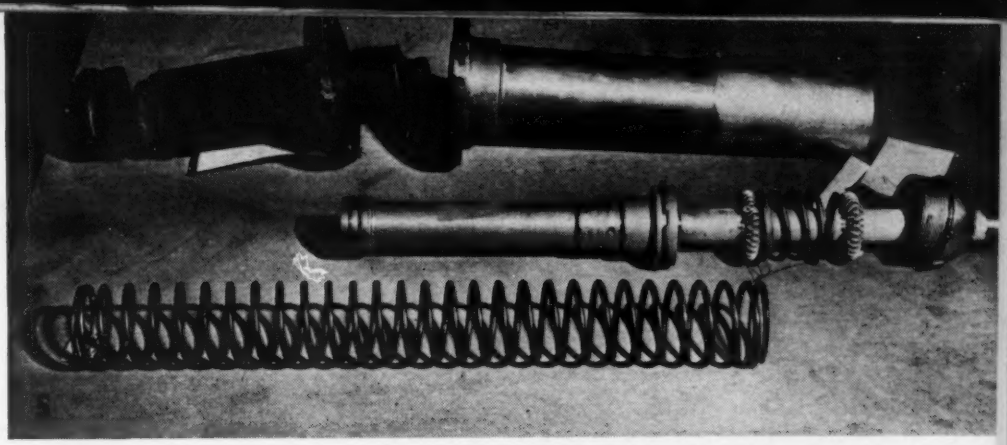
the blast-control valve, allowing the retracted contacts to reclose by spring action. If the fault is still on the line, the trip coil will again be energized and the above cycle will be repeated. An air-operated auxiliary switch permits full opening (disconnection) after one or more reclosings.

Principle of Operation

Design of the breaker is thus quite different from that of high-voltage circuit-interrupting devices of American or other European manufacture. The principle of arc extinguishing is quite simple, but, as indicated, the breaker is somewhat complicated with pneumatic valves, air cylinders and piping and other mechanical features. Unlike other breakers the arc is extinguished in *free air*, instead of within a chamber of some kind, which is unique. For full current interruption with reclosure, only the operating heads with their retractable contacts are in operation. The rotating columns come into action and the interrupting heads are widely separated only in case of a permanent fault, after the adjustable number of reclosures and subsequent openings indicate that the fault is permanent.

Due to this principle the reclosure may be adjusted to be very rapid, or as fast as the operating engineer considers necesary to get rid of the ionized atmosphere at the place of the extinguished arc. For instance, reclosure may be accomplished in about ten cycles (dead time, i.e., time elapsed between the extinction of the first arc and the reclosing of contacts) after the fault is interrupted and the arc extinguished. This, however, would be purposeless because the remaining products of the fault are (hot, ionized air) will permit reignition of the arc. Successful reclosures of this breaker were made with about seventeen cycles of dead time. Single-phase faults are opened and reclosed individually. If reclosure of a single pole is not successful, all three poles swing wide open.

The breaker to all appearances interrupts charging current in about five or six cycles without any visible evidence of distress. One experiment was tried with opening the line charging current of a 230-kv. line 70 miles in length and another with 170 miles of line. Oscillograms showed that line charging current interruption proceeds inside of six cycles, but with many restrikes, which restrikes may be a potential source of system overvoltages. For instance, on the BPA system, specifications call for not more than one restrike on 230-kv., three-cycle line breakers.

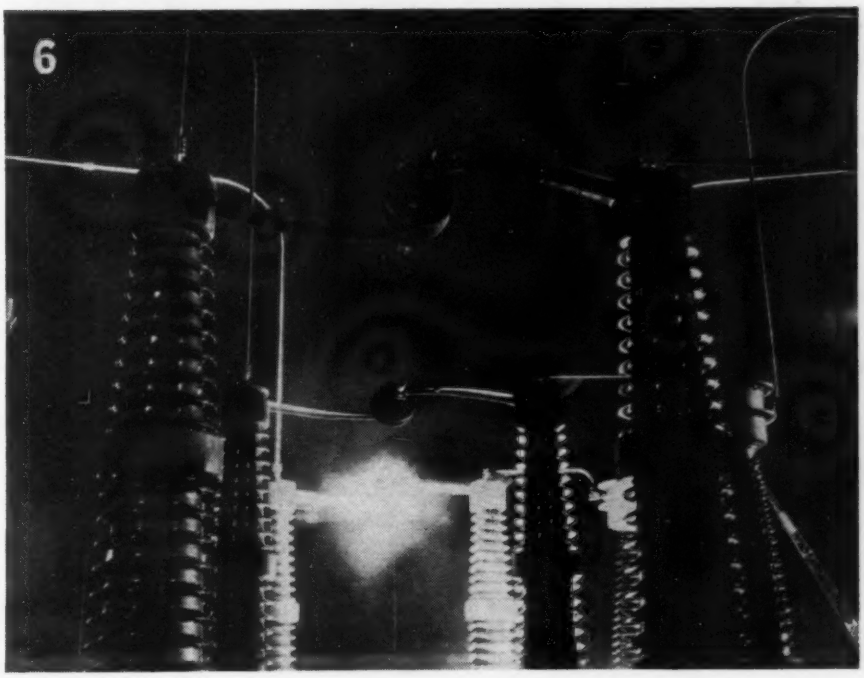


DISASSEMBLED MECHANISM from an arcing head. Hollow piston in center goes inside cylinder at top. Long spring below bears against piston ring holder in center of rod to reclose contact after opening air pressure is automatically cut off. Coiled springs on right-hand end of rod are for conducting current from cylinder walls to contact rod

Extreme simplicity and ease of maintenance of current carrying parts of this breaker were a feature attracting attention and approval of the operating engineers witnessing the test. Because of breaking the arc in free air the condition of contacts is immediately observable and it is a simple half-hour or less operation to recondition the contacts.

Two points need to be developed in this German breaker—elimination of restrikes in interrupting line charging current and speeding up operation so that fault currents can be interrupted in three cycles, as is possible with most modern high-voltage American breakers. Several of the manufacturers' circuit breaker specialists present were favorably impressed by performance and possibilities of the breaker and left in a highly inventive mood. If the breaker can be speeded up as several felt sure it could be, possibly by reducing the distance the high-pressure air must travel up the insulator columns and out through the arms, and if the more difficult problem of restrikes can be whipped, then operating men see in the breaker the possibility of less costly equipment, the elimination of oil, less weight, and a great reduction in the cost and time of maintenance.

NIGHT VIEW of arc on phase "A" while interrupting single-phase fault at full current rating. Circuit opening and high-pressure air blast make a noise like a 75-MM. gun



More Output—Less Space With Infrared Oven

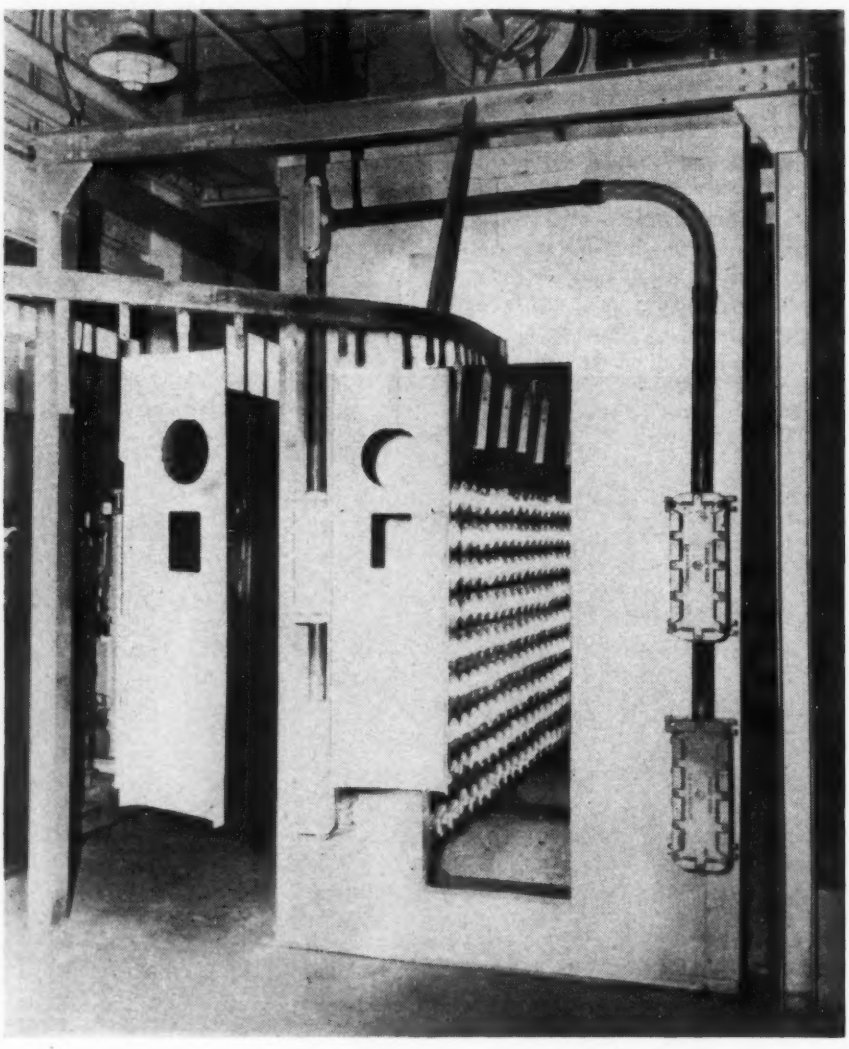
J. F. GSCHWIND *
J. O. Ross Engineering Corp.
New York, N. Y.

Total of 1,152 reflector lamps provide heat for paint drying in two ovens fully enclosed and insulated—Circulating air maintained at constant temperature—Ovens erected on conveyorized production line fit into a limited space

AMONG the manufacturers who seized the opportunity to change and improve their production means and thereby profit from technical war developments was Martin & Schwartz Inc., Salisbury, Md., producers of gasoline pumps.

Few people know that such a pump has more than 3,000 parts. The sealed metering device, the pump and the computor are delicate pieces of machinery and must be protected from the weather and from mechanical abuse; hence they are enclosed in a strong cabinet. The metal housing is painted in vivid colors to attract the motorists as well as preserve the metal. The cabinets are made of No. 16 gage pressed sheet steel. With the exception of the rounded hood the component parts are fairly flat, the largest being 59 in. long and 25 in. wide.

ENTRANCE of prime coat oven. Note use of explosion proof electrical fixtures

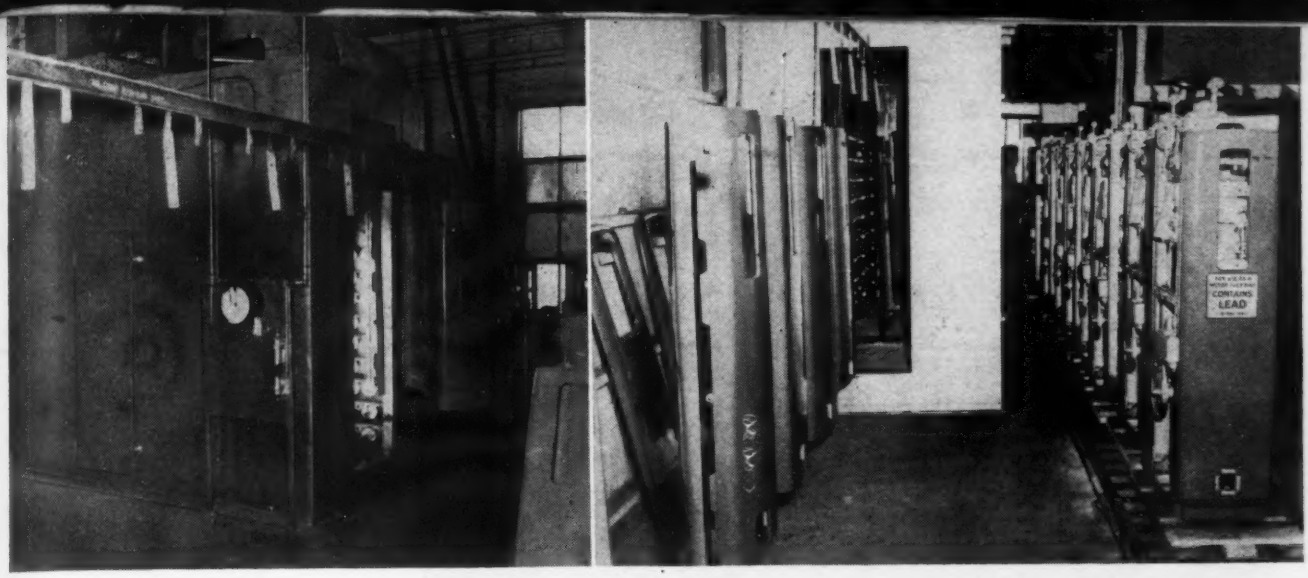


While the pump cabinets were previously covered with air dry coatings it was found that a baked enamel is more resistant to continuous outdoor exposure and that better paint adhesive and rust preventing qualities can be obtained by metal degreasing and bonderizing systems. Such improvements and a larger production were planned by Martin & Schwartz during the past year. But all such changes and conditions required considerable space which was not readily available.

Painting Process

A continuous conveyorized production line that would fit into a limited space had to be devised. It was decided to suspend all panel work from a monorail conveyor and to use a roller train for the propulsion of the pump assemblies; the latter being complete with pump, motor, meter, etc., cannot be subject to baking temperatures and are consequently coated with an air drying paint. This is accomplished in a prime coat spray booth. All panels and sheet metal enclosures receive the first covering of gray enamel in the same booth after

* Development Engineer.



AIR TEMPERATURE controller at exit of prime coat oven and air circulating fan on top of oven (left) . . . Exit of finishing oven (right) and view of pump assembly conveyor

having first been bonderized. They are then suspended from a monorail conveyor by specially designed hooks and proceed through the prime oven for a bake of 5 min. reaching a temperature of about 300 deg. F. The finish coat, which is generally a glossy red, blue or white, is applied in the second spray booth from where the panels progress on the same conveyor to the finishing over for an 8-min. bake attaining a final temperature of about 300 deg. F. The pump chassis conveyor and the monorail converge in the final assembly department where the panels, having sufficiently cooled, are mounted.

Limitations Involved

Available floor space was extremely limited and the ceiling height of 11 ft. did not grant much clearance for placing equipment above the ovens; a space saving oven design had therefore to be found.

Steam, propane gas, oil and electricity were given consideration as heat sources but steam was immediately ruled out because of lack of boiler capacity. Although there are a few applications where open burners are installed inside the oven, it is not good practice especially when inflammable solvents are being liberated. External gas or oil burner arrangements are relatively cumbersome, however, particularly when they cannot be located above the oven or on platforms.

In spite of the fact that infrared lamps are not considered to be strictly explosion proof, they seemed to offer the best solution in this case, when installed in a properly ventilated enclosure. Preliminary tests by Martin & Schwartz Inc. indicated, furthermore, that the paint baking by infrared could be done about three times as fast as by conventional convection methods.

Another consideration was the plant location which is adjacent to a dusty coal yard and which made it mandatory to keep as small as possible the fresh air intake.

Oven Specifications

All of these factors led to the installation of Ross Airay ovens which combine the conditions of infrared radiation with proper ventilation. The oven characteristics are as follows:

Prime Oven: 12 ft. long, 4 ft. 4 in. wide, 9 ft. 6 in. high, 432-250 watt reflector lamps wired in balanced circuits for 220-volt, 3-phase, 60-cycle current. Maximum input 108 kw.

Finishing Oven: 20 ft. long, 4 ft. 4 in. wide, 9 ft. 6 in. high, 720-250 watt reflector lamps wired in balanced circuits for 220-volt, 3-phase, 60-cycle current. Maximum input 180 kw.

Both ovens are fully housed and insulated and the solvent vapors and fumes are expelled over the roof of the building by small exhaust fans. A circulating fan and distributing ducts assure even ambient air temperatures throughout the oven cross section.

The production rate of the installation requires relatively short ovens with large entrance and exit openings. These make it difficult to maintain uniformly high temperatures at the ends of convection ovens, whereas infrared lamps remain effective for their full length.

The manual switching on or off of lamp groups permits a variation of electrical input and makes it possible to energize the selective number of lamps to suit the size and shape of the work being handled. An automatic air operated recorder controller maintains the circulating air at a constant temperature.

Airay ovens are designed with due consideration to heat transfer principles according to which:

The heat absorbed equals the heat retained plus the heat lost or minus the heat gained.

The last term can be either positive or negative depending on the prevailing conditions surrounding the stock. It is hence only a logical step forward to trap the heat losses and keep the ambient air as warm as conveniently obtainable.

Explosion Proof Switchgear

In accordance with the requirements of the fire underwriters all electrical switchgear near the ovens is of the explosion proof type. The main panel board with multi-breakers, relays, contactors and disconnect switches is located in an adjacent room which is free of paint fumes.

The conveyor drive and the infrared lamp banks in each oven are electrically interlocked so that the heat is turned off whenever the conveyor stops. It is hence impossible to spoil the stock by over baking due to conveyor stoppage. A further safety measure is the interlock of the fan drives and the oven switch insuring the purging of the ovens before the heat can be turned on.

HOW

DESIGN • CONSTRUCT • OPERATE • MAINTAIN

Magnesium Anode Protection of Transformer Tanks . . . III*

L. J. GORMAN
Assistant Engineer
Consolidated Edison Co.
of New York, Inc.

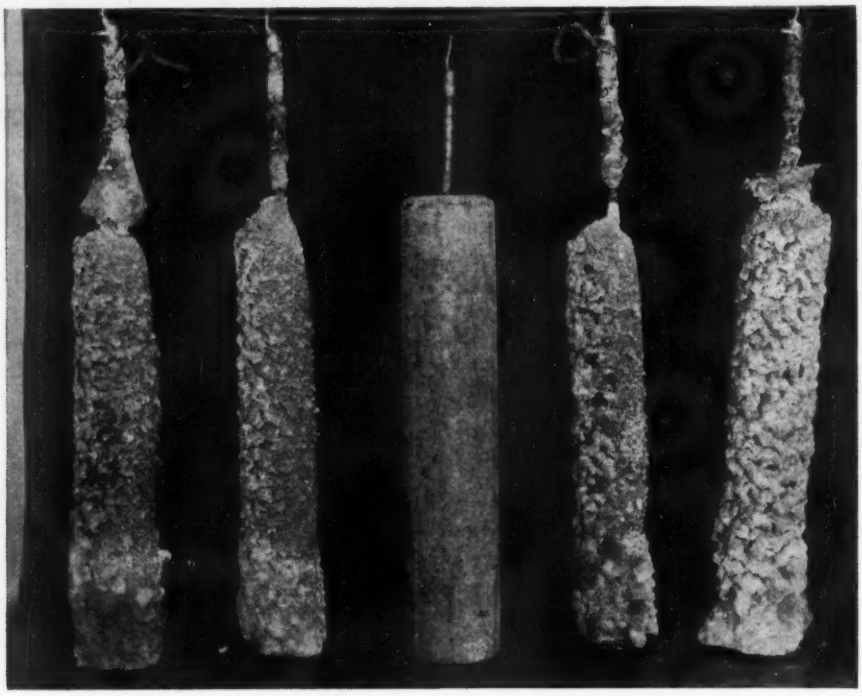


FIG. 4—Magnesium anodes: original state (center) and appearance of four other anodes after 287 days of continuous service

CONTINUING the outline of experience and field data on the use of magnesium anodes for the cathodic protection of transformer tanks, current and voltage measurements were supplemented by placing steel coupons at fixed positions on each transformer, as indicated in Fig. 2.* The fixed coupons became coated with a thick gray deposit which adhered firmly to the exposed metal. This deposit also appeared at numerous spots and streaks on the surface of the transformers, and on the manhole hardware, such as cable racks, hangars and cutouts, wherever iron was exposed. A chemical analysis of the coating showed the following:

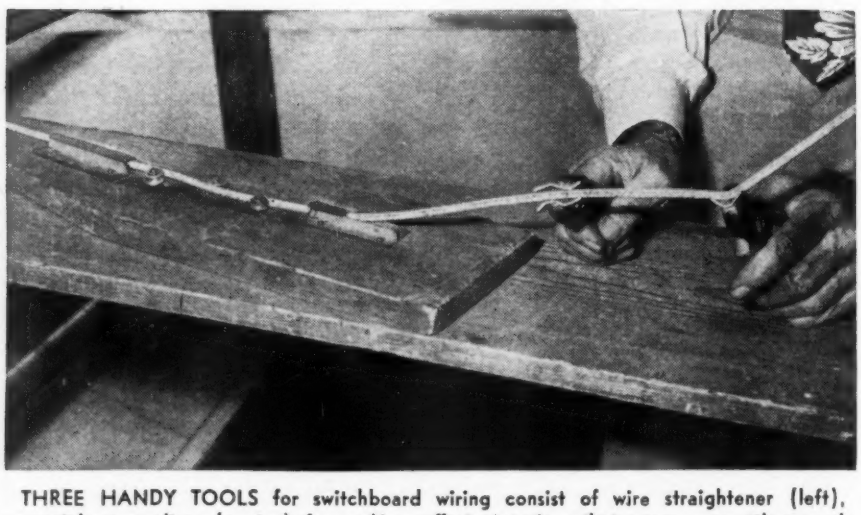
Magnesium hydroxide, $Mg(OH)_2$	75-85%
Calcium carbonite, $CaCO_3$	10-20%
Magnesium carbonate, $MgCO_3$	about 5%
Iron corrosion products	Trace

The coating seemed to have considerable protective value because there was no trace of corrosion on the coupon metal under the coating. Furthermore, the effectiveness of the deposited coating continued for one month after the anodes were disconnected.

Fig. 4 shows a magnesium anode at the beginning of the test and appearance of other anodes after 287 days of continuous service. The initial current delivered by the four anodes to the transformer tanks, and to the various other metallic surfaces exposed in the manhole, amounted to 2.5 amp. As polarization developed, the current decreased to 1.45 amp. and remained substantially constant for the remainder of the 287-day

* Concluding a series which began in Electrical World, March 29, 1947, page 74. Illustrations are numbered in sequence throughout the series.

Switchboard Wiring Tools



THREE HANDY TOOLS for switchboard wiring consist of wire straightener (left), special nose pliers (center) for making offsets in wires that cross over others and another pair of pliers (right) with special nose for making perfect right-angle bends. To make the plier tools, pieces of metal formed to the desired shape were welded to the nose pieces of ordinary cheap gas pliers. Addy Gay, of California Electric Power Co., Riverside, Calif., devised these convenient tools. They save time and make possible neat factory-type switchboard wiring on the job

period. The average current for the entire period, including the initial values, was estimated at 1.5 amp. The weight of the magnesium metal consumed amounted to 26.5 lb., or approximately 50 percent of the metal available.

The initial open-circuit potential between anodes and the transformers amounted to 1.0 volt. This value was decreased by polarization to 0.45 volt. It was noted that the polarization occurred entirely at the cathode. There was no noticeable polarization at the magnesium anodes. Also, it was noted that the deposit which formed on the exposed metal was 0.46 volt anodic to the metal.

It was obvious that the current density obtained in these tests, with the anodes directly connected, was considerably more than that required for protection. In future installations, it is proposed to limit the anode current by adjusting the resistance of the circuit so that the current delivered to the test coupon at the tank surface will amount to 1.0 to 1.5 milliamperes per square inch of exposed metal. It is believed that current densities of this order will be sufficient to give protection in most cases; and the life of the anodes should be increased considerably. It is believed that this use of magnesium as an anode metal for the cathodic protection of transformers is sufficiently promising to warrant the continuation of further tests and experiments.

• • •

Responsibility in Installing Oilostatic

PAUL B. BOYD
Underground Distribution Engineer
Georgia Power Co.

INSTALLATION of the five-mile run of 110-kv. Oilostatic cable* involved division of responsibility between customer and manufacturer as to furnishing materials and services. The manufacturer (Okonite-Callender Cable Co.) furnished the following:

1. Necessary cable for the specified circuit length including risers with suitable allowance for splicing.
2. Steel pipe in double random lengths. Pipe was to be coated with an asphalt mastic type of covering.
3. Necessary riser pipes and two terminating assemblies for the termination of each end of the circuit.
4. Six 161-kv. cable terminals and materials.
5. Complete oil-pressure pumping plant and electrical control to maintain oil pressure at 200 psi. in pipe.
6. Necessary oil for circuit.
7. Joints.
8. Small piping, fittings, and other miscellaneous equipment and materials necessary to provide a working system.

The manufacturer also furnished, during the installation period, the evacuating, air-drying, and pumping equipment for conditioning the pipe and oil-filling of the pipe and the equipment for pulling the cable into the pipe. The manufacturer further furnished engineering supervision of the pipe-type cable system up to the time it was ready to go into service. The manufacturer trained four cable splicers and a foreman to splice 110-kv. cable.

Provided by Power Company

Georgia Power Co. furnished the necessary labor to install the pipe-type cable system:

1. Cut the paving, excavated, and backfilled the trench.
2. Repaved the roadway over the trench, or in the sidewalk area, had a contractor replace the sidewalk.
3. Located, welded, and placed the pipe in the trench. Placed asphalt-mastic covering over welded joints in pipe. Material for mastic covering over pipe joints was furnished by cable manufacturer.
4. Poured concrete shield above pipe, furnishing concrete for same.
5. Constructed the manholes, furnishing material for same.
6. Erected riser pipes and structures for cable terminals.
7. Conditioned the pipe, installed

*See article page 42 this issue.

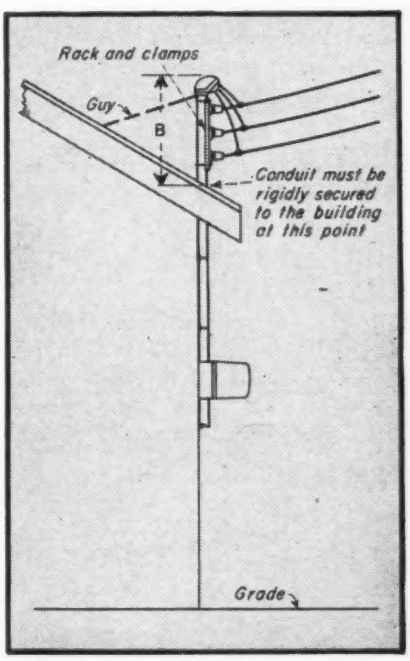
Service Drop Support for Low Buildings

ANCHORING SERVICE drops to service conduits on low buildings is permitted by the Indianapolis Power & Light Co. when an approved method is used. The company furnishes the service rack and clamps for installation by the contractor.

The service conduit is specified as a minimum size of 1¼ in., galvanized, and must extend a minimum of 24 in. above the roof in order to provide space for the service rack. A larger sized conduit may be required under same conditions. A No. 6 copperweld guy wire is also required for longer spans or high extensions.

Minimum height of the bottom wire is 10 ft. and the maximum height, 8, over the top support is as shown in the following tabulation for the service spans and wire sizes shown.

Wire	Span	B
2 No. 8	80 ft.	4½ ft.
3 No. 8	75 "	4 "
3 No. 6	60 "	3 "
3 No. 4	55 "	2½ "



CONDUIT EXTENSION, above building roof is permitted for service drop support, under special arrangements

the cable, joints, and cable terminals, and filled the pipe with oil. This work was done under the supervision of the manufacturer's engineers.

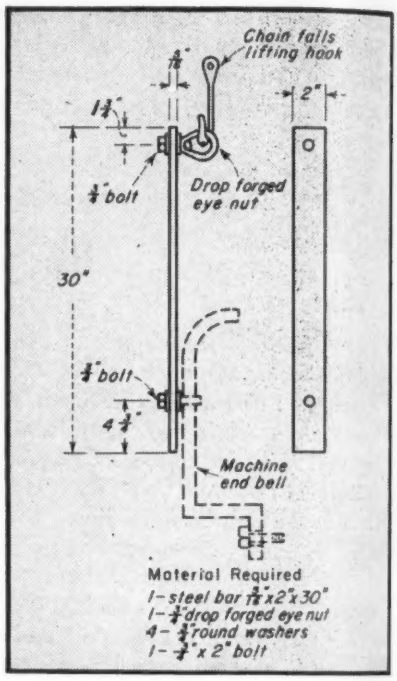
8. Provided the necessary housing for the oil storage and pressure maintaining equipment and installed same. The installation of this equipment was done under the supervision of the manufacturer's engineers.

9. Transported all materials from the railroad siding to the installation.

• • •

Lifting Device for Handling End Bell

IN FACILITATING overhaul of a frequency changer set at the Millbury, Mass., operating center of the New England Power System, the removal and reinstallation of end bells was cared for by a lifting device designed by Lester M. Johnson of the central division maintenance department. It consists of a steel bar 30 in. long with a drop-forged eye nut at one end and a hole drilled and tapped for a $\frac{3}{4}$-in. bolt about 5 in. from the other end. The device requires that the end bell also be tapped and drilled for a $\frac{3}{4}$-in. bolt. It also helps in the handling of a rather awkward piece of equipment and prevents possible damage to the winding and turns. By keeping the end bell vertical it can be brought into position against the stator frame and easily bolted into place. This is done by keeping the lifting eye nearer the center of gravity than was feasible with the old method of lifting by an eyebolt in the end bell. It also enables the end bell to be turned so that it can be lined up with the bolt holes in the frame.

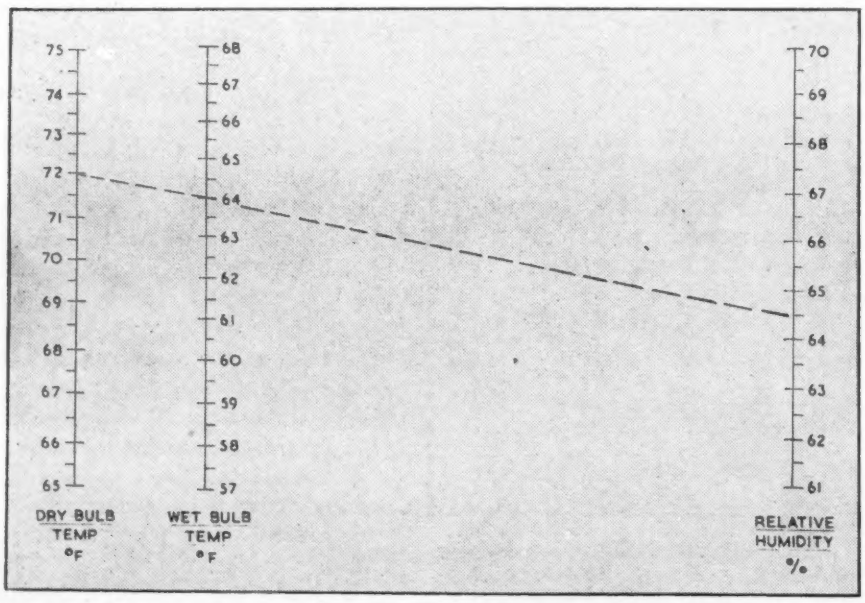


DETAIL of lifting bar and material needed for end bell handling

Read Relative Humidity Direct From Nomogram

CHART is a convenient and quick means to relate thermometer readings to humidity. Relative humidity is obtained by direct reading on the respective scale (right) by placing a straight edge across the chart through the values of measured dry bulb and wet bulb temperatures (left).

Development of this nomogram is outlined by E. C. Woods in an article, "Measurement of Atmospheric Humidity," published in *Distribution of Electricity*, Vol. 19, No. 163, July, 1946 (London, W. T. Henley's Telegraph Works Co.). It is constructed for an empirical relationship which applies only to the ranges 61 to 70 percent relative humidity and 65 to 75 deg. F. from tables for a barometric pressure of 30.0 in. of mercury. Barometric variations, however, have negligible effect on the relative humidity except for precise scientific measurements for which no pretense is made that this chart or the usual sling psychrometer will suffice.



Rules for Stringing Wire

A PROCEDURE for stringing wires as outlined here is an adaptation from the handbook and safety rules of the Portland (Ore.) General Electric Co.

When stringing bare conductors parallel with and over wires operated at more than 750 volts, the lower wires shall be deenergized. If it is unavoidably necessary to string the conductors over energized wires, they shall be strung as follows:

1. Wires shall be strung singly.

2. The wires being strung shall be run through grounded metal blocks placed between the reel and the point where it is possible for the wires being strung to contact live wires.

3. The reel tenders shall be insulated from the ground and shall wear rubber gloves.

4. Each wire when strung shall be pulled up and dead-ended permanently or temporarily, and be definitely known to be clear before starting to string subsequent wires.

KILOVAR ECONOMICS #3

Johnny says:

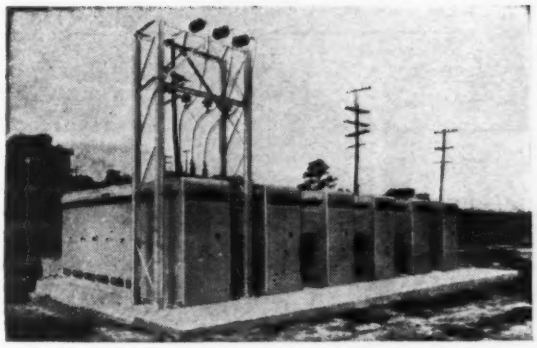
"Every kilovar that goes through your step-up transformers may come *down* THREE TIMES!"

Why use your "de luxe" transportation facilities to step *UP* and carry kilovars through your high tension lines, *DOWN* to your sub-transmission lines, *DOWN* to your distribution lines, and finally, *DOWN* to the point of consumption.

On-the-spot kilovar generation by capacitors rids your lines of transported kilovars. This makes room for increased kilowatt capacity—equivalent to as much as 20 per cent of your peak load*—and *effectively reduces transmission and distribution costs from the generator all the way out to the load.*

It's as simple as this

If the transmission and distribution lines and substations of your system are worth, say, $150 per kilowatt transmitted, why should kilovars which can be supplied at an installed cost of $10 each be using these valuable facilities?



A General Electric specialist will be glad to work with you on the application of capacitors to your system. For further information ask your G-E representative or write to *Apparatus Dept., General Electric Co., Schenectady 5, N. Y.*

THESE SYSTEMS ARE NOW TAKING ADVANTAGE OF CAPACITORS TO CUT INVESTMENT COSTS

Here are the names of companies, typical of the industry, which are now using capacitors as an important economic tool: New Orleans Public Service Inc., with capacitors equal to 21 per cent of its peak load. Tampa Electric Company—20%; Oklahoma Gas and Electric Company—20%; Illinois Power Company—18%.

**Assumes 80% power factor operation.*

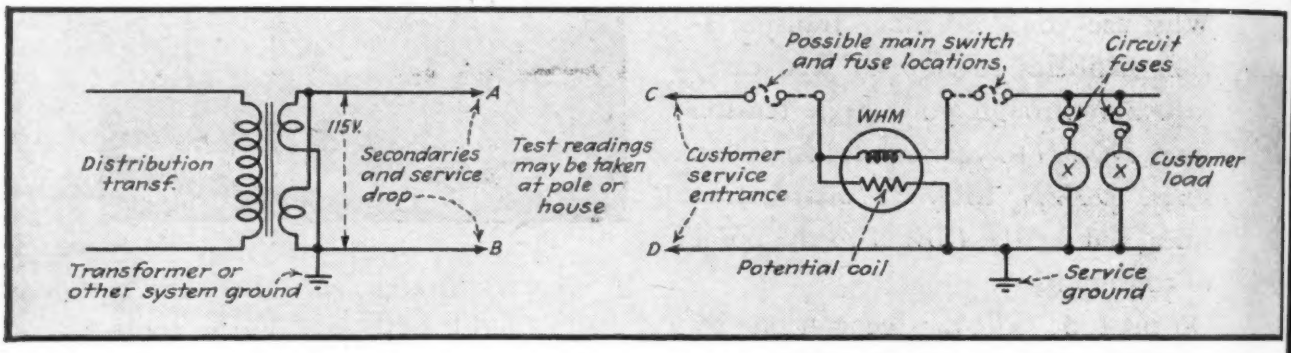
GENERAL ELECTRIC

407-114-5700

How to Identify Grounded Conductor On Customer's Service Connection

METHODS for making connection tests on two-wire and three-wire, single-phase services are an adaptation of standards of New England Power System, Boston. These tests should be made between the service drop and customer's entrance wire or cable before they are connected. A rectifier type voltmeter, such as Weston Model No. 605, or equivalent, is to be used for this purpose

TWO-WIRE, SINGLE-PHASE OR NETWORK SERVICE



1. Where customer's main switch is on line side of meter, it should be opened.

The following voltage readings will then be obtained.

A—C = 0	B—C = 0
A—D = 115	B—D = 0

The A—D = 115-volt reading will identify A as the live leg of the service drop and D as the grounded leg of the service entrance.

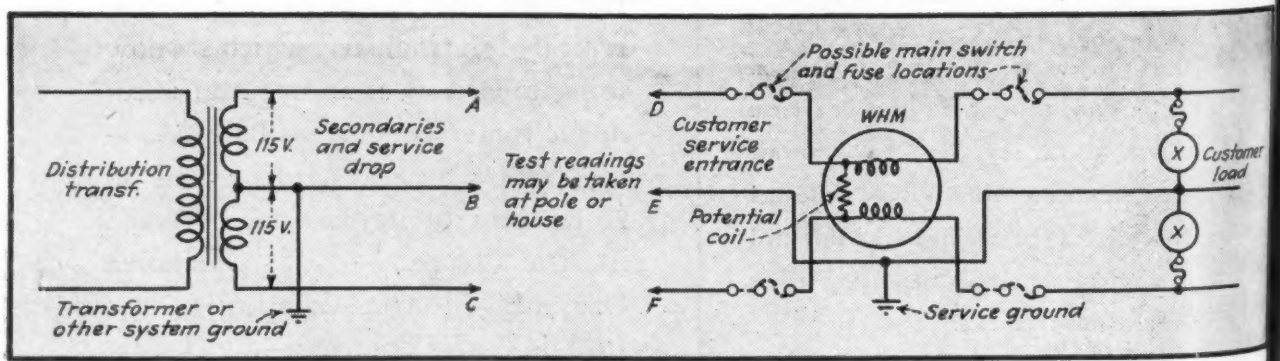
2. Where customer's main switch is on load side of meter, it should be opened and meter potential lead should be disconnected. In case of Type S meter, removal of meter from socket will be equivalent to both of these operations. The test can then be made as in item 1 above.

Option: If it is inconvenient to disconnect meter potential lead, visual inspection may be made within the premises to determine to which leg the ground is connected and then by means of color code which is grounded conductor at service entrance.

In this case C and D will both be at ground potential and readings A—C and A—D will both be 115 volts while B—C and B—D will both be 0.

The 115-volt readings across A—C and A—D identify A as the live leg of the service drop.

THREE-WIRE, SINGLE-PHASE SERVICE

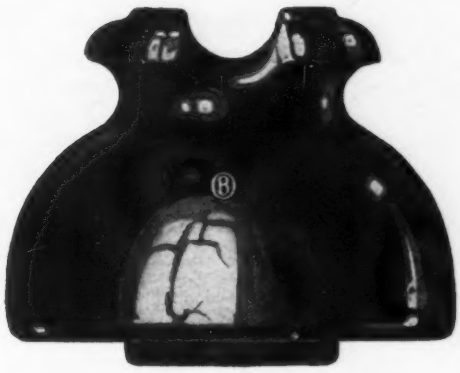


3. Customer's main switch should be opened; voltage readings will be:

A—D = 0	B—D = 0	C—D = 0
A—E = 115	B—E = 0	C—E = 115
A—F = 0	B—F = 0	C—F = 0

The 115-volt readings across A—E and C—E will identify A and C as the live legs of the service drop and E as the ground leg of the service entrance.

MADE TO TAKE A "SUNDAY PUNCH"



Once in a while a prize fighter gets on the wrong end of a "Sunday Punch". Lost: one fight!

Insulators know what a "Sunday Punch" is like, too. Lightning delivers it. Small pintypes can't prevent this terrific voltage, but good ones can do the next best thing--they can still be there when it's over.

And don't assume this is common with *just any* pintype. A lot of ingenious design, tedious testing, and fine manufacturing technique has gone into O-B's low-voltage line of insulators to make it proof against lightning puncture.

To keep down repair runs and keep up good public relations, O-B pintypes can be relied upon to do *their* part.

Specify O-B insulation on your new construction plans.

2823-H

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Ohio Brass

MANSFIELD, OHIO

CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONT.

How to Calculate Cable Diameters*

Summations of diameter increases of coverings and lead sheath for various assemblies of conductors give final outside diameter of cable

Coverings

	Diameter Increase inches
SEPARATORS	
Paper Fold (0.001 in. paper)	0.003
Paper Fold (0.002 in. paper)	0.006
Paper Wrap (0.0025 in. paper)	0.008
Cotton Wrap (size 80's)	0.006
COTTON BRAIDS	
Size 14–1	0.030
12–1	0.034
10–1	0.038
8–1	0.042
60–2	0.017
40–2	0.024
30–2	0.032
20–2	0.040
14–2	0.046
10–2	0.058
8–2	0.064
6–2	0.074
4–2	0.090
BRAID FINISHES (Weatherproof types)	
Up to 0.200 in. O.D	0.003
0.200 in. to 0.500 in. O.D	0.005
0.500 in. and over	0.008
TAPES	
0.010 Cable Tape (A.S.T.M. lap)	0.030
0.010 Cable Tape (half lap)	0.040
0.012 Cable Tape (A.S.T.M. lap)	0.036
0.015 Cable Tape (A.S.T.M. lap)	0.045
0.022 Skim Tape (A.S.T.M. lap)	0.066
SPECIAL COVERINGS	
Asbestos Braid (14–2–2)	0.125
Asbestos Braid (10–2–2)	0.156
Flat Steel Armor Tape	2 × tape thickness
Jute Serving (16–3)	0.125
Sisal Braid (32-lb. Java)	0.190
Hawser Cord or Seine Twine (10–2–3) Braid	0.140
Presaturated Duck Tape (half lap) 8 oz	0.120
SHIELDS	
Metal Tapes	3 × tape thickness
Cooper Wire Braids—4 ends or less	4 × diam. individual wires
Copper Wire Braids—5 to 7 ends	5 × diam. individual wires
Cooper Wire Braids—over 7 ends	6 × diam. individual wires

Conductors

No. of Single Conductors	Diameter Over Assembled Core
2	2.0 x single condr. diam.
3	2.155 x single condr. diam.
4	2.414 x single condr. diam.
5	2.7 x single condr. diam.
6	3.0 x single condr. diam.
7	3.0 x single condr. diam.
8	3.305 x single condr. diam.
9	3.61 x single condr. diam.
10	4.0 x single condr. diam.
12	4.155 x single condr. diam.
14	4.41 x single condr. diam.
16	4.7 x single condr. diam.
18	5.0 x single condr. diam.
19	5.0 x single condr. diam.
20	5.17 x single condr. diam.
22	5.3 x single condr. diam.
24	6.0 x single condr. diam.
26	6.0 x single condr. diam.
28	6.155 x single condr. diam.
30	6.414 x single condr. diam.
33	6.7 x single condr. diam.
37	7.0 x single condr. diam.

No. of Paired Conductors	
1	2.0 x single condr. diam.
2	3.5 x single condr. diam.
3	4.0 x single condr. diam.
4	4.5 x single condr. diam.
5	4.8 x single condr. diam.
6	5.2 x single condr. diam.
7	5.5 x single condr. diam.
8	5.7 x single condr. diam.
9	6.0 x single condr. diam.
10	6.4 x single condr. diam.

Thickness of Lead Sheath (A.S.T.M. or I.P.C.E.A.)

Diameter of Core, inches	Thickness of Lead Sheath, 64ths inch	mils
0 to 0.425	3	47
0.426 to 0.700	4	63
0.701 to 1.050	5	78
1.051 to 1.500	6	94
1.501 to 2.000	7	109
2.001 to 3.000	8	125
3.001 and larger	9	141

The thickness of lead sheath for flat twin cable shall be that corresponding to the major core diameter.

Example . . . Cable Diameter Calculation

Given: 20-conductor, 600-volt control cable consisting of No. 12 Awg. stranded bare copper, cotton wrap separator, rubber insulation, color coded cotton braids, assembled with 0.012 tape over core, lead sheath, jute serving.

Find: Final diameter of cable.

Solution:

Step 1—Determine outside diameter of individual braided conductors:

	inches
(a) Conductor diameter (from stranding table)	0.092
(b) Diameter adder for separator (from table)	0.006
(c) Diameter adder for insulation (2 x 600-volt rubber insulation thickness from other tables)	0.094
(d) Diameter adder for 30-2 color coded cotton braid (from table)	0.032
	0.224

Step 2—Determine diameter over assembled taped core:

(a) Diameter over assembled 20-conductors (from table) (factor of 5.17 x 0.224 in. single conductor diameter)	1.158
(b) Diameter adder for 0.012 in. cable tape with A. S. T. M. lap (from table)	0.036
	1.194

Step 3—Determine final diameter over jute served lead sheath:

(a) Diameter adder for lead sheath (2 x lead sheath thickness from table for above diameter 1.194 in.)	0.188
(b) Diameter adder for jute serve (from table)	0.125
Final Outside Diameter	1.507

* From advance pages of a forthcoming technical manual to be issued by Rome Cable Corp., Rome, N. Y.

Kearney Fuse Links

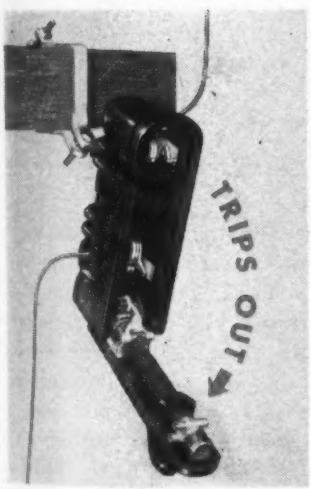
● Lower Fuse Costs
● Provide Close Coordination

KEARNEY patented Fuse-Paks keep fuse links in perfect condition. Each link separately wrapped, cannot become tangled or bent. Convenient carton protects against damage from dropping or rough handling. Eliminates loss due to breakage—and bulk packaging often causes losses as high as 30%.

Save Time in Stock Room. Fuse-Paks are easy to store—easy to dispense. Ratings are clearly marked—simplifies counting inventory.

Convenient for Troubleman. Handy package hooks onto belt or slips into pocket. Fuse links are held in the Fuse-Pak—they cannot fall out, they must be *pulled* out. No loss of time due to installing damaged link.

Close Coordination. Careful selection of materials, precision manufacturing, expert assembling and rigid inspection assures maximum uniformity. You are assured of close coordination when you use Kearney Fuse Links. Specify Kearney for all your fusing needs. They are available for all modern types of cutouts.



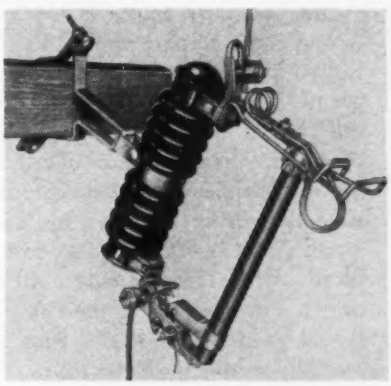
7500 Volt, 100 ampere Kearney TRIP O MATIC Catalog No. 5770—20

Kearney TRIP O MATIC

Reduce losses due to unnecessary service interruptions. Design features include ease of fusing, and visual indication when an outage occurs. Convertible to disconnect switch by using door with solid blade. Available in 50 and 100 ampere sizes, 5 and 7.5 KV.

Kearney TRIP-OUT

Simple trip-action mechanism assures positive interruption on overloads as well as short circuits. Point pressure contacts assure good conductivity. Re-fusing is quick and easy. Available in ratings 5 to 69 KV, 100 and 200 amperes.



7500 Volt, 100 ampere Kearney Trip-Out, Series B, Catalog No. 6739

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An ELECTRICAL WORLD *Comparison of Service Practices . . .*

III—Starting Current Rules Vary Over Wide Range

Small single-phase motors sold in appliances on national market . . . Local requirements would bar many

AGREEMENT has never been reached among the utilities and the manufacturers on the values of single-phase motor starting currents that should be permitted. This agreement is needed particularly in the field of fractional-hp. motors used in residential service. Washing machines, furnace stokers and blowers and, more recently, unit air conditioners have offered the major problem.

There is considerable variation in the permissible starting currents as stated in utility regulations for electric service. The accompanying tabulation of locked rotor currents permitted for 120-volt motors shows, however, that there has been a definite swing toward one proposed basis of agreement. Eleven companies give recognition to the time factor in application of the motors by permitting a higher value for "infrequently started" compared to "frequently started." The terms "manually controlled" and "automatically controlled" are also used for this purpose.

One company refers to the higher locked rotor ampere value (40 amp.) for all purposes, and five companies permit ½-hp. motors, which are within this value in most designs. Three companies have a limit of 20 amp. for all purposes and two companies state the rating in lower hp. values, ¼ and ⅓. It is of interest to note that in all of the 17 cases where 40 amp. or ½ hp. are permitted, the rules were issued in 1942 or since, with eight in 1946 or still in draft form.

Maximum Locked Rotor Current Permitted for Single-Phase 120-volt Motors

(22 Companies)

9 Companies have adopted this rule...	Frequently Started...	20 amp.
	Infrequently Started..	40 amp.
1 Company has increased values.....	Frequently Started...	30 amp.
	Infrequently Started..	40 amp.
1 Company states.....	General Purpose.....	½ hp.
	Infrequently Started..	40 amp.
3 Companies Limit Value for All Purposes.....		20 amp.
1 Company Permits Value for All Purposes.....		40 amp.
1 Company States Maximum Rating.....		¼ hp.
1 Company States Maximum Rating.....		⅓ hp.
4 Companies State Maximum Rating.....		½ hp.
1 Company States Maximum Rating.....		¾ hp.

1941 Proposed Agreement

Practically all of the fractional-hp. motors that are sold for use in residences, and in commercial service also, are integral parts of complete appliances which are manufactured for national markets. It is therefore unusually desirable in this case that some standard values to govern design should be acceptable on a national basis.

An attempt to set up a joint agreement among electricity supply companies and manufactures came close to success in 1941. It was not adopted, but a part of the proposal was partially agreed to in 1945. Acceptance by individual companies is, of course, the only method for adoption of any standards and the trend in this direction in spite of the initial failure of the joint committee agreement is important.

The companies using the dual values for 120-volt motors also use the 240-volt values that were proposed. On a voltage fluctuation basis, 25-amp. locked rotor current is permitted for 240-volt motors automatically controlled or frequently started, and 50 amp. is permissible for those manually controlled or infrequently started. In general, it is considered that motors of ½ hp. may be used at 120 volts on manual controlled units such as room air conditioners and that 240-volt service would be required for ¾-hp. and larger units.

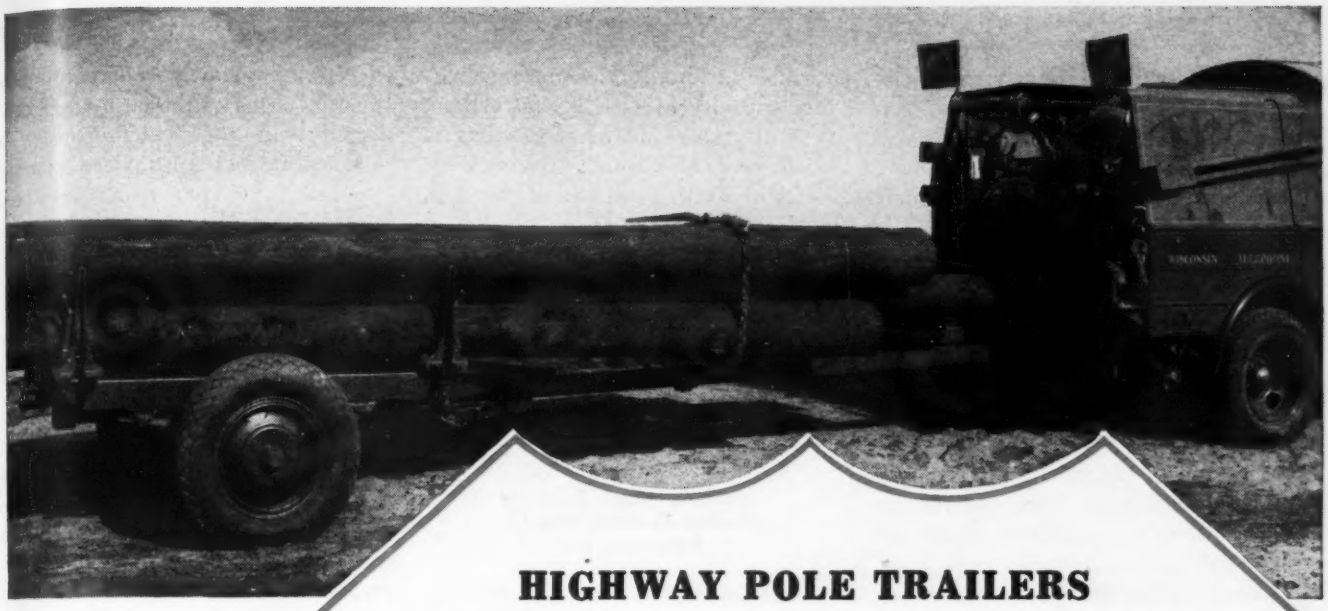
Largest Motor Permitted on Single-Phase Service (240-volts)

- 3 Companies permit maximum of 7½ hp.
- 10 Companies permit maximum of 5 hp.
- 2 Companies permit maximum of 3 hp.
- 7 Companies have rules based on other load or location

Larger Motors

A majority of companies will permit the connection of 5-hp., single-phase motors on 240-volt services. As shown in the accompanying tabulation, three companies also permit 7½ hp. while two companies place the upper limit at 3 hp.

Seven companies have requirements based on the total connected load or the service facilities at the particular location, and no single value is given for the maximum motor size. In two cases where larger sizes are permitted, it is especially noted that if three-phase service is reasonably close, motors of the higher ratings may be required to be served



HIGHWAY POLE TRAILERS
HIGHWAY CABLE REEL TRAILERS
speed handling, save money

Specially designed Highway Trailers make simple work of transporting poles and cable reels. No special truck and bolster is needed to move a heavy load of poles when you use the modern Highway Pole Trailer coupled to any line construction truck. Highway Cable Reel Trailers load heavy cable reels quickly, simply by tipping trailer back until saddles engage the reel spindle, then pulling tongue down and coupling to any truck.

Over a quarter-century of successful trailer-building experience has gone into these trailers. Like other Highway utility equipment, they are in high favor with men in the field, because Highway products are built by men who know field problems.

Get all the facts about Highway Line Construction and Maintenance Bodies, Earth Boring Machines, Winches, Power Take-offs, and Derricks. Your inquiry will receive immediate attention. There is no obligation.

HIGHWAY TRAILER COMPANY

Manufacturers of

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EDGERTON, WISCONSIN, U. S. A.

three-phase rather than single-phase.

In a majority of the rule books, customers are urged to consult with the company before purchasing larger motors, either single-phase or three-phase. Attention is called to the variable factors, service entrance wiring, capacity of distribution system, type of motor and number of times it will be started, which determine the size and starting current permissible.

One company rule has been stated to determine starting current limitations in terms of the customer's connected load and with separate allowance factors for motors starting less than once per hour and those starting more than once per hour.

• • •

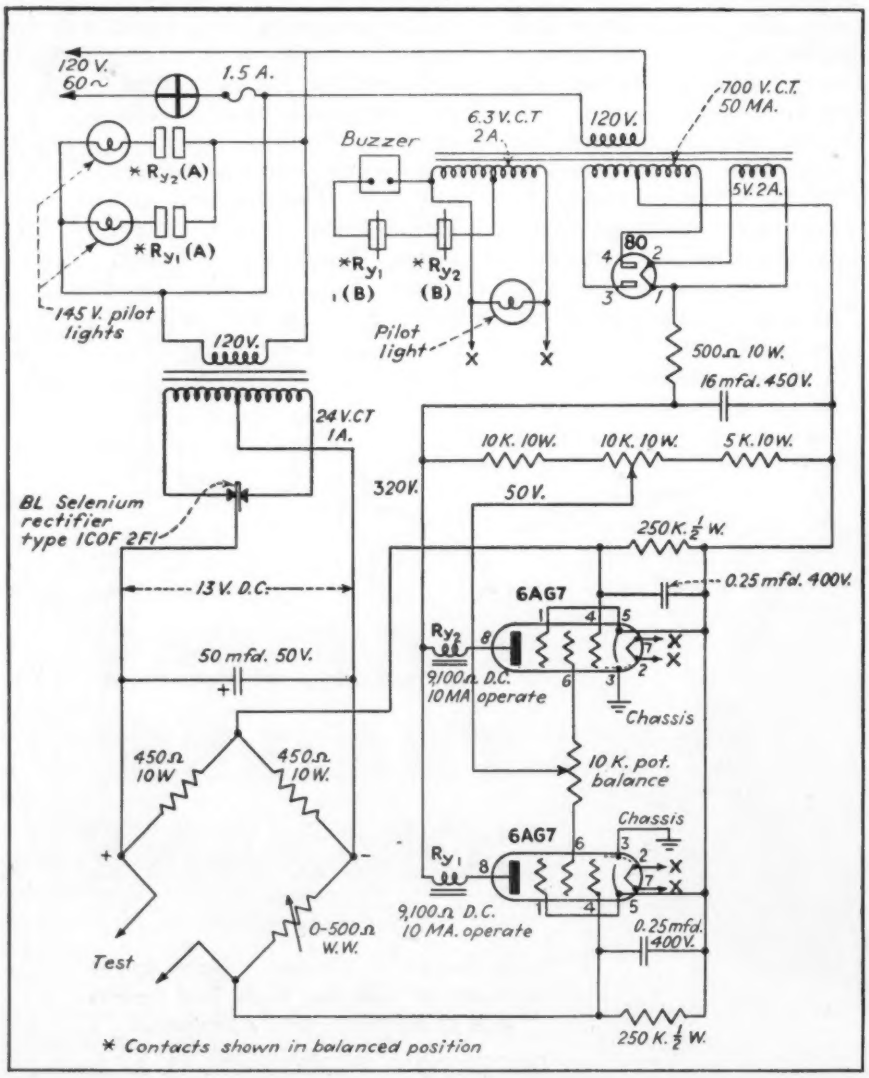
Bridge Indicates Right Coil Selection

G. N. BURKHART
Assistant Chief Engineer
Duncan Electric Mfg. Co.
Lafayette, Ind.

TESTING of potential coils is one of the nuisance items in the manufacture of watthour meters. Coils of 120- and 240-volt ratings comprise a large percentage of the total potential coil production. In the Duncan design, the former has 2,700 turns and a d.c. resistance of approximately 75 ohms and the latter 5,400 turns and 300 ohms. These coils are given the customary tests during fabrication for shorts, opens, and number of turns. The various coils are identified by different colored wrappers and by a perforated number in the wrapper.

It is necessary to see that the proper potential coil has been used in the assembly of the completed electromagnet and that the coil has not been open or short-circuited during handling (the color of the potential coil wrapper is obscured by black insulating varnish after assembly, and an independent check on the perforated marking in the wrapper is desirable). Various indicating ohmmeters have been used in the past, but these depend upon an operator to correctly judge meter readings. An indicator has now been developed which relieves the inspector of the responsibility of making decisions as to good or bad readings.

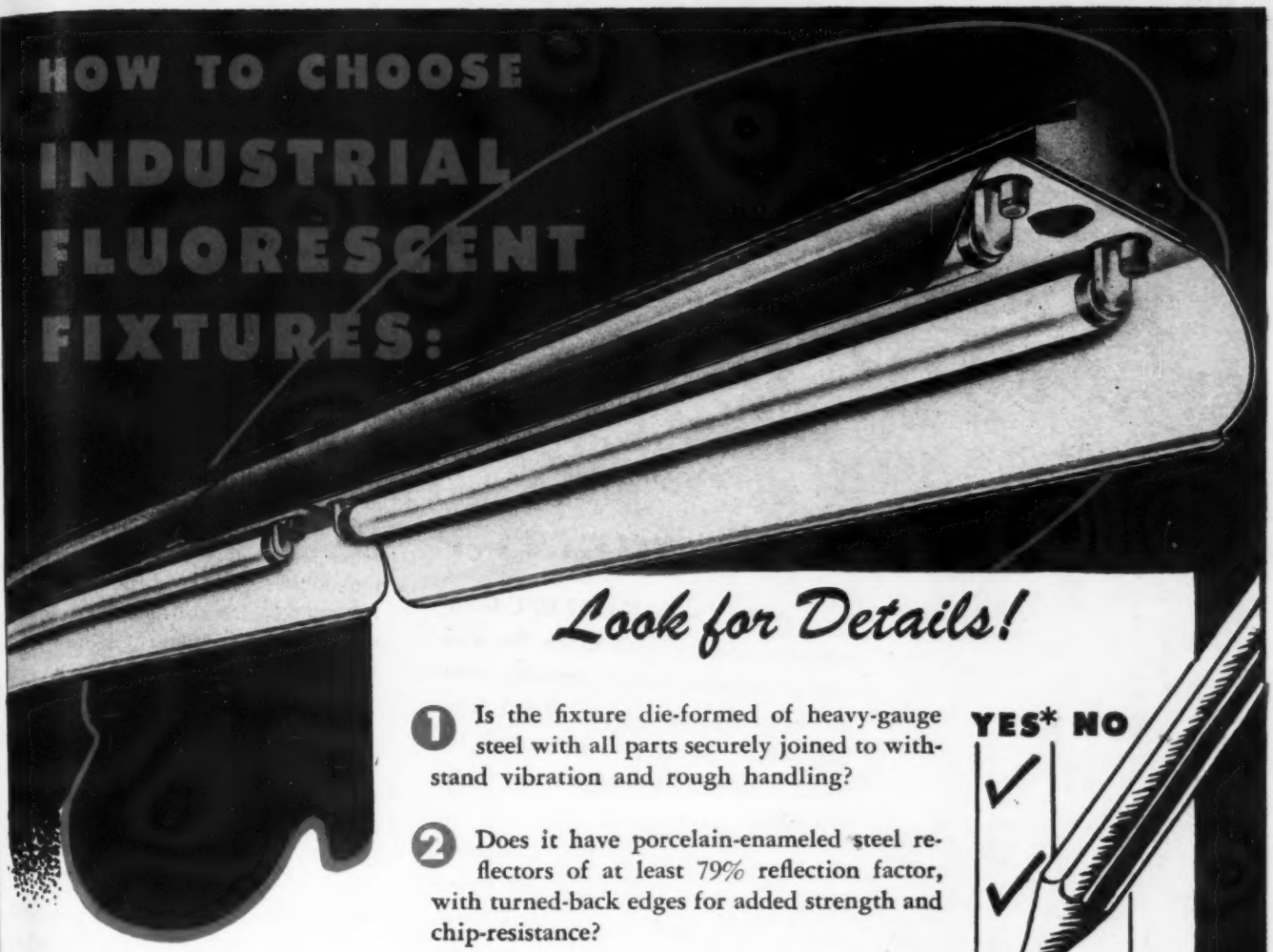
IF wrong (240-volt) potential coil is selected for insertion in a (120-volt) watthour meter a buzzer indicates the error



A d.c. relay is connected in the plate circuit of each tube. The screen voltages are adjusted so the relays are closed when the bridge is balanced and the screen potentiometer varied so that the relays operate at the same grid voltage differential. At balance when both relays close, a circuit is established to operate a buzzer. If the resistance under test is too high, the first relay releases,

This new coil checking device consists of a Wheatstone bridge, containing two fixed arms, the coil under test and an adjustable standard resistor, powered by a low voltage d.c. source (13 volts). The output voltage of this bridge is applied to the control grids of two Type 6AG7 tubes, and the midpoint of this voltage obtained from a center-tapped resistor and connected to their cathodes. Therefore, when the bridge is balanced, both grids are at zero potential; but, as it is unbalanced one way, the grid of the first tube goes positive and the grid of the second negative; as it is unbalanced the other way, the grid of the first tube goes negative, and the grid of the second positive.

HOW TO CHOOSE INDUSTRIAL FLUORESCENT FIXTURES:



Look for Details!

	YES*	NO
1 Is the fixture die-formed of heavy-gauge steel with all parts securely joined to withstand vibration and rough handling?	✓	
2 Does it have porcelain-enameled steel reflectors of at least 79% reflection factor, with turned-back edges for added strength and chip-resistance?	✓	
3 Do all construction details meet RLM standards? Does it bear the Underwriters' Label?	✓	
4 Are there plenty of knockouts for quick, economical installation in any manner—surface, suspension, unit or continuous?		
5 Is it designed for easy maintenance? Can starters be replaced without disturbing lamps? Can reflectors be quickly removed and replaced without tools?		
6 Is it engineered to distribute maximum glareless light evenly on the working plane—as proved by actual distribution curves?		

* **"YES" MEANS DAY-LINE**

You'll find the proof in our Bulletin 30A. Send for it and compare.

Day-Brite Lighting, Inc., 5425 Bulwer Avenue, St. Louis 7, Mo.
Nationally distributed through leading electrical supply houses.
In Canada: address all inquiries to Amalgamated Electric Corp., Ltd., Toronto 6, Ontario.

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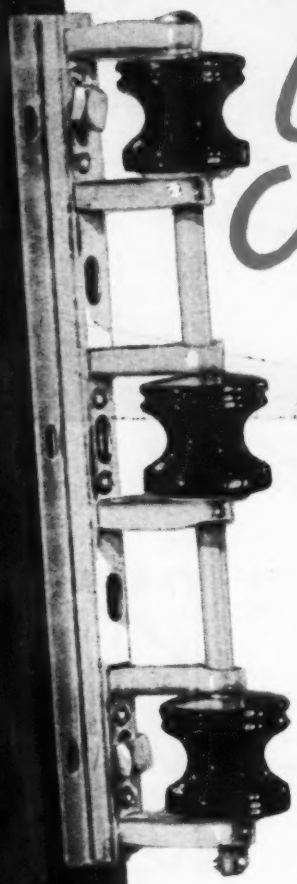
IT'S EASY TO SEE WHEN IT'S

DAY-BRITE *Lighting*

Look to Locke for Distribution Materials...



Secondary Racks

for instance...

Here is the Locke No. 0738 U-thru secondary rack with three No. 355 wet process porcelain spools—one of a complete line. Metal and porcelain parts are designed together and made together to work together.

"U-thru" refers to the U-shaped steel points which hold the spool bolt and spools in position. Formed separately, they are inserted thru slots in the back of the rack and riveted to provide an assembly of maximum strength.

Locke racks are protected by ***Permazinc*** — Locke's ***Quality Controlled*** double hot-dip galvanizing — for extra years of dependable performance.

Complete lines of distribution materials are maintained in six Locke regional warehouses and in most distributors' stocks. Call in your Locke representative.

Depend on Locke for Quality Controlled distribution materials—pole line hardware and insulators. One order covers both.

Locke **POLE LINE HARDWARE and INSULATORS**

LOCKE INSULATOR CORPORATION • BALTIMORE 3, MD.

energizing a red pilot light and opening the buzzer circuit. If the resistance is too low, the second relay releases, and a blue pilot light operates in a similar manner. Type 6AG7 tubes were selected for their current carrying capacity which matched the characteristics of available relays, and for their high g_m which gives a large change in plate current with a small change in grid voltage. Should higher sensitivity be desired, a higher d.c. voltage can be applied to the bridge.

This test device has proved to be very reliable and fast in operation. The operator presets the standard resistance for the particular rating of coils being tested. He touches the coil leads to the bridge terminals and listens for the buzzer. If the buzzer does not operate, the coil is defective or of the wrong rating, and it is laid aside for later disposition.

•

Grounding Rules For Deenergized Lines

GROUNDING INSTRUCTIONS presented here are a selection from the safety rules of Portland General Electric Co., Portland, Ore.

Protective grounds shall be applied to deenergized lines that normally carry 7500 volts or over between conductors, for protection against static, lightning, crosses with foreign circuits, as well as accidental energizing from normal sources of power.

After the load dispatcher or person acting for him has given clearance on lines or apparatus to be deenergized, the person receiving the clearance shall inform all men working under his supervision that lines or apparatus are "supposed to be" dead; and, before starting any work, shall test and ground the lines or apparatus. Other lines or apparatus within the reach of workmen shall be properly protected.

Applying the ground shall be the first thing done; and removing it, the last.

One ground shall be applied at each side of the part to be worked on if the nature of the circuit is such that it is possible to energize it from either direction.

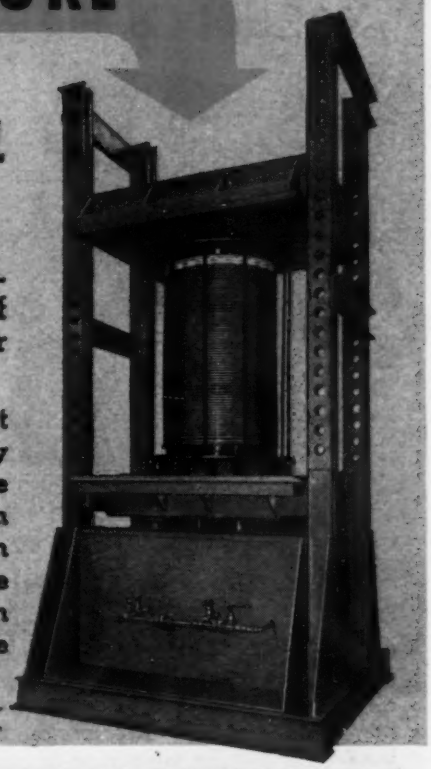
Except when switch or switches are in full view of the workmen, or if installing the second ground is consid-

PUTTING ON THE PRESSURE

GIVES POSITIVE PROOF THAT YOUR TRANSFORMER WILL WITHSTAND SHORT CIRCUITS

It's sure. It's positive. No guess work. No wishful thinking. Putting on the pressure is an added measure of safety engineered into every Pennsylvania Transformer with helical or pancake coils.

THIS IS WHAT WE DO — We calculate the total short circuit force that would be produced by a short circuit at the secondary terminals with the rated voltage maintained on the primary. We compress the coils with this pre-determined force and treat them in such a manner that they are self-supporting, and will maintain their shapes when mounted on the core. Strong supports are provided at the top and bottom of the coils to keep the coils in their precompressed shapes. No movement can take place in the transformer coils, even under the most severe short circuit.

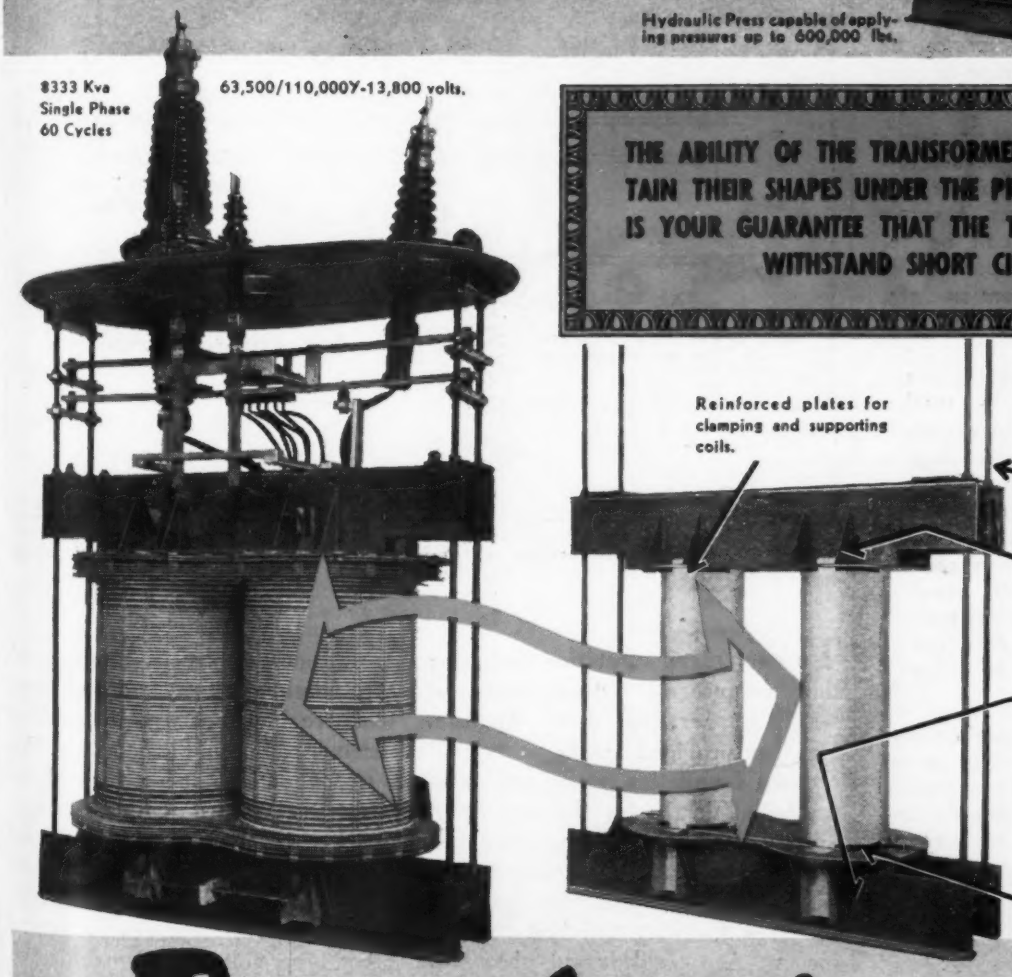


Hydraulic Press capable of applying pressures up to 600,000 lbs.

8333 Kva
Single Phase
60 Cycles

63,500/110,000Y-13,800 volts.

THE ABILITY OF THE TRANSFORMER COILS TO MAINTAIN THEIR SHAPES UNDER THE PRESCRIBED PRESSURE IS YOUR GUARANTEE THAT THE TRANSFORMER WILL WITHSTAND SHORT CIRCUITS.



Reinforced plates for clamping and supporting coils.

Tie rods for connecting top and bottom core frames and for clamping coils.

Clamping plates hold coils to their precompressed size. Note the ruggedly constructed side-frames, the extra strong bolts, nuts and rods.

Drum cut away to permit cooling oil to flow past core steel.

Pennsylvania
TRANSFORMER CO., PITTSBURGH, PA.

Pennsylvania TRANSFORMERS

Where and How to Use *Crapo* Steel Conductor

Ask for This Guide to Low-Cost Rural Lines!

If future plans call for the extension of rural service, be sure to ask for a copy of this Manual! A study of its contents will show where and how *Crapo* Steel Conductors can be used to profitable advantage in rural distribution systems.

This illustrated book contains pertinent data on the electrical characteristics and electrical performance of these unique conductors. It shows how construction costs can be reduced by the use of long spans, gives initial and final sag and tension data, describes construction practices, cites typical installations.

Crapo Steel Conductors are especially applicable to rural taps and branches where construction and maintenance costs are important considerations. The experience of a number of leading utilities over a period of years shows conclusively that *Crapo* Steel Conductors are giving dependable, economical and efficient service on thousands of miles of line in rural areas.

Crapo Steel Conductors are distributed by Graybar Electric Company, Inc. Ask a Graybar representative for a copy of the *Crapo* Steel Conductor Manual or write direct for Manual No. 110-C.

Indiana Steel & Wire Company
Muncie, Indiana

Crapo
Steel Conductors

ered a greater hazard than omitting it, then one ground will be sufficient.

Station ground switches when closed may be considered as one of the two grounds required.

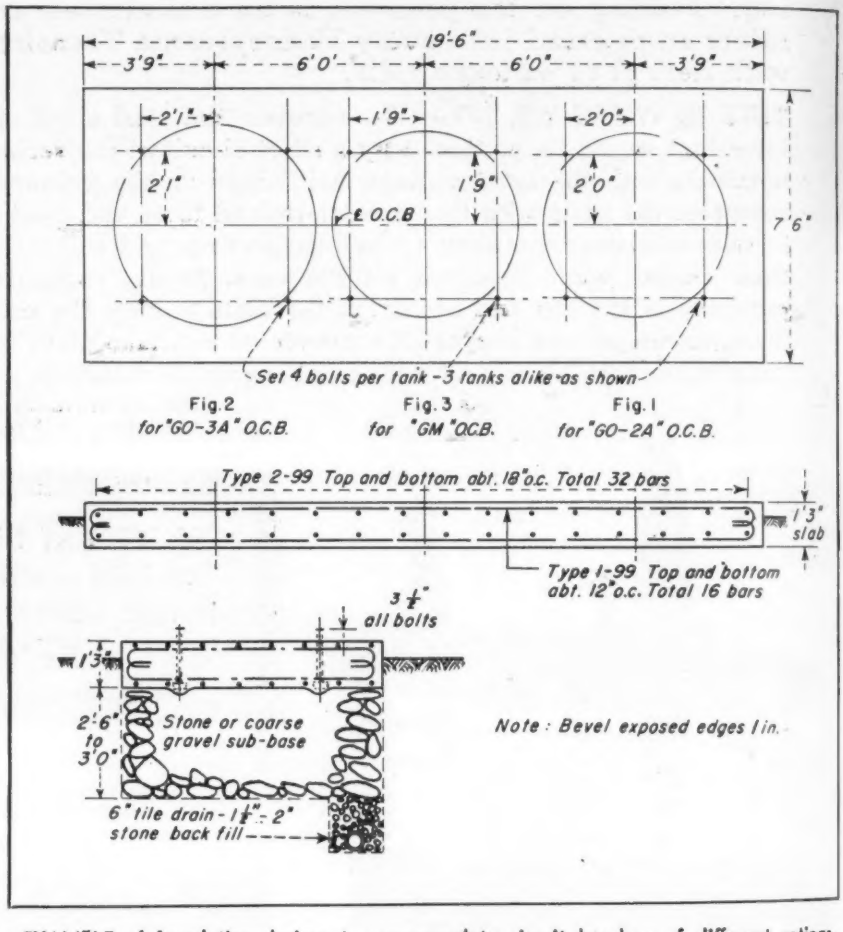
The second ground may be installed on same pole or tower provided work is done between the two grounds.

Before applying the ground device it shall first be attached to the best available ground and shall be located in such a manner that it will not be disturbed while the work is being done.

In removing a grounding device, the connection shall be removed from the line wires before disconnecting the device from the ground.

• • •

Reducing Foundation Design Work



EXAMPLE of foundation designs to accommodate circuit breakers of different ratings for 115-kv. service

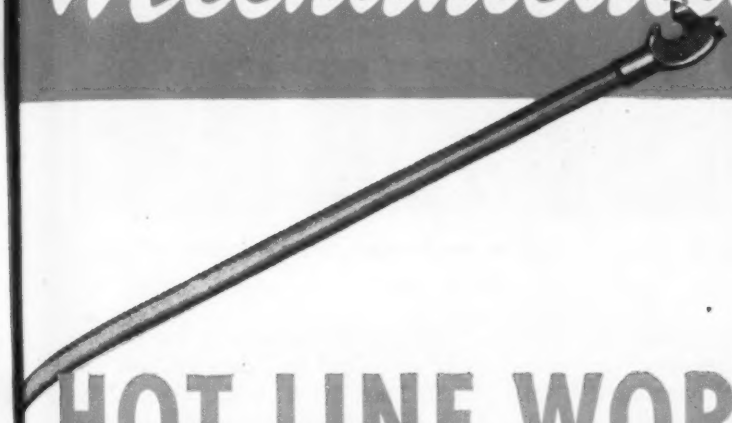
To FACILITATE substation designing the engineering department of NEPSCO Services, Inc., Augusta, Me., has provided among other procedures foundation plans and reinforcement details for the support of oil circuit breakers. These show concrete mat dimensions, reinforcing rod sizes, spacings and arrangement, drainage facilities and bolt requirements. A typical layout sheet for Westinghouse 115-kv. breakers is shown, with mounting bolt spacing for type "GO 2-A" (Fig. 1); type "GO 3-A" (Fig. 2); and type "GM" (Fig. 3). All these have been used in specific substations on the company's transmission system, and such representative locations are indicated on sheets used within the company. Thus far, foundations using these details have been installed in nine substations of the Central Maine Power Co. and Public Service Co. of New Hampshire.

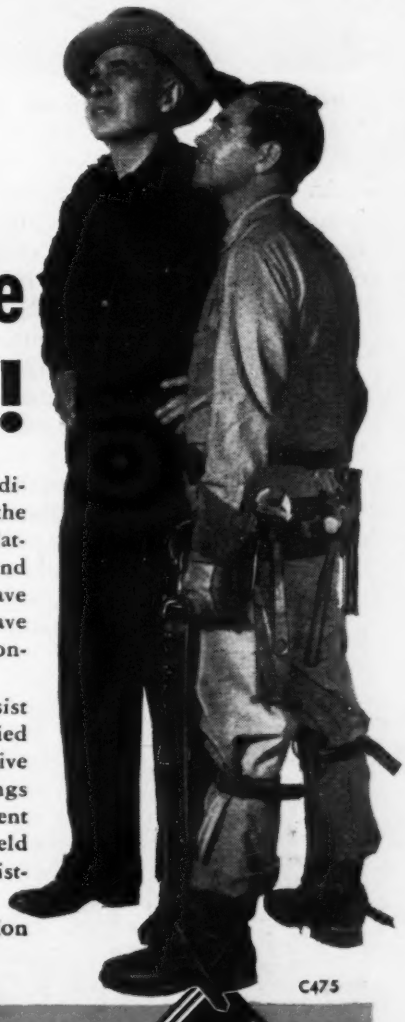
Other sheets maintained in the department cover circuit breakers of other type, voltage and manufacture. Time is saved in drafting room and field work by being able to refer to these designs in blueprint form, with their ready adaptation to conditions outside the office.

HOT LINE TOOLS

ALUMINUM (HEAT-TREATED)* Alloy...

Mechanically Improved





C475

HOT LINE WORK made EASIER - - - SAFER!

Linemen, Foremen, Superintendents, and Safety Directors who are concerned with Hot Line Maintenance work will readily see the many advantages of this new development. Chance Hot Line Tools fitted with heat treated aluminum alloy castings will make the lineman's work easier and safer because of the increased strength, the mechanical improvements and the weight reduction. Tests prove that a very slight difference in the weight of a tool head makes a considerable difference in the effort required to handle the tool from the butt end. This reduced weight minimizes fatigue and helps linemen to complete jobs more quickly and efficiently with less effort.

The reduced weight and mechanical improvement in pole saddles, chain tighteners, etc., made possible by the use of aluminum, helps linemen in attaching platforms, auxiliary arms and wire tongs to the pole. Additional safety has also been included in the redesigned line. For example, the new platform is now provided with twin braces and is considerably lighter. Wire tongs have increased strength and the larger tongs have increased capacity to handle the larger conductors being used today.

Chance Hot Line Tools are tested to resist 75,000 volts per foot. Poles are kiln dried and laminated to prevent warping and to give them greater strength. All aluminum fittings are subjected to a special heat treatment which greatly increases the tensile and yield strength, the hardness and corrosion resistance of the alloy.

These new tools are already in production and should be available to you soon.

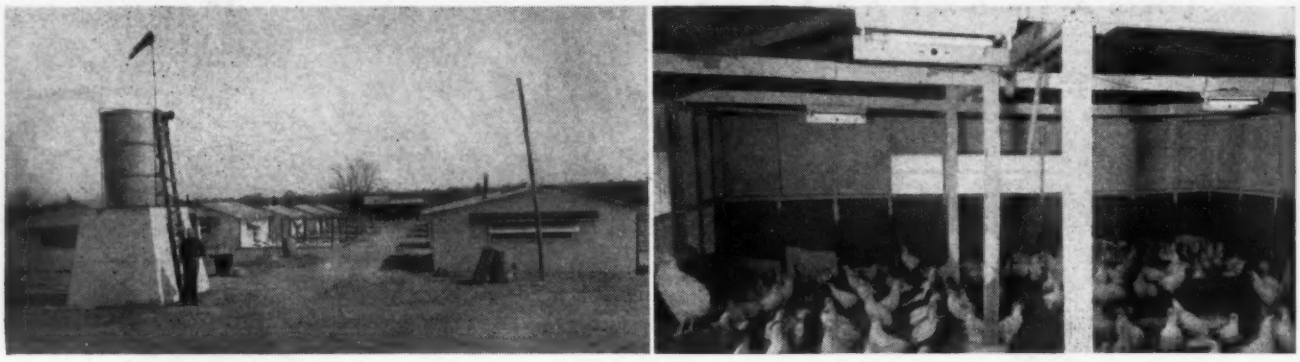
A·B·CHANCE CO·

CENTRALIA, MISSOURI · SAN FRANCISCO, CALIFORNIA

ABC INDUSTRIES

LOAD BUILDING

Germicidal Lamps Prevent Roup Among Chicks



INSTALLATION of 27 germicidal lamps was made in these brooder houses, three lamps per brooder, to prevent cold epidemics

AN INSTALLATION of 27 germicidal lamps has been credited with preventing most cold epidemics among chicks on the farm of Lt. Col. Eugene Morris, U.S.A.A.F., retired, who lives six miles south of Shreveport, La. "The lamps won't cure colds, but they have certainly prevented epidemics in my flocks," says Col. Morris.

Germicidal lamps were installed in the brooder houses by Col. Morris as the result of conferences with lighting engineers from Southwestern Gas and Electric Co., which serves the Shreveport area. Lighting men inspected the brooder houses and first recommended four 15-watt units for each house. However, because the houses were unusually well ventilated it was decided that three units would do the job.

Each of the nine brooder houses on the Morris farm was equipped with three lamps. The installation was made in August, 1946, and since that time approximately 12,000 chicks have been processed without an epidemic of colds, and without the administration of any internal medicines. As a result of this experience the grower is convinced that the lamps are effective in killing airborne germs in brooder houses.

The brooder houses are frame construction, sheet rock covered, and are 20 ft. long, 20 ft. wide, 7 to 12 ft. high with a slightly peaked roof. The shiplap and rolled roof has an opening 2 ft. long by 2 ft. wide, covered by a sliding cap.

All lamp fixtures were purchased at nominal cost and the installation cost was quite low because the low wattage per fixture made it possible to plug into existing lighting outlets. The equipment is being operated 24 hr. a day and consumes less than 40 kw.-hr. per month per house, according to the electric company's rural service engineers.

• • •

Photo—H. V. Rickner

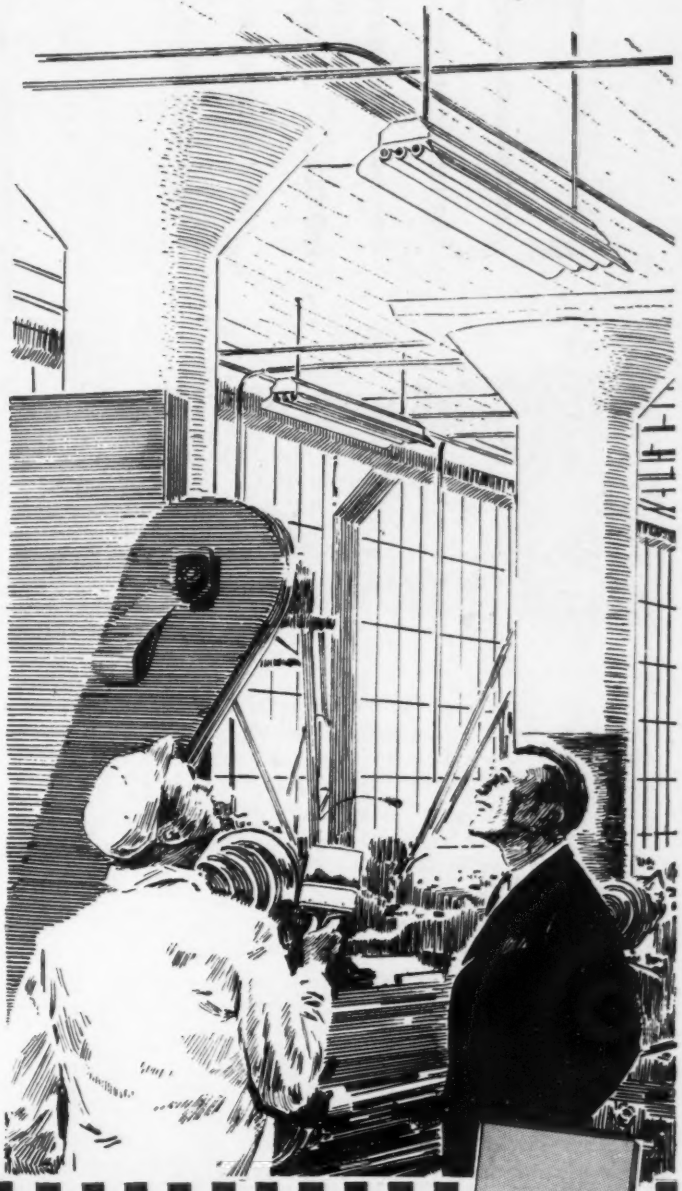
MOTOR-OPERATED animal exerciser gives a 300 ft. per min. rate of walking

Farm Animals Exercised By Motor Power

AN ELECTRICALLY driven exerciser which accommodates six animals at one time has been set up by Judson Morgan on his Windwood farm near Canandaigua, N. Y., and power is furnished by the Rochester Gas & Electric Co.

The rotating apparatus is operated by a 1-hp., 230-volt, single-phase motor through reduction gears. Center frame is erected on a concrete pad

GOOD LIGHT Needs an "Indoor Sky"



White Ceilings and Walls Mean Better Light and Better Sight

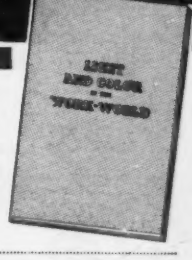
THE SKY, by reflecting and diffusing sunlight, makes lighting endurable out of doors. Otherwise, as every Illuminating Engineer knows, the sun would be harsh and glaring . . . shadows dark and opaque . . . seeing both difficult and uncomfortable.

In the industrial plant, lighting fixtures "bring sunlight indoors" to provide the light so necessary for quick, easy and accurate seeing.

But like its natural counterpart this "artificial sunlight," too, needs to be reflected and diffused if glare, harsh shadows and brightness contrasts are to be minimized and adequate illumination is to be provided at reasonable cost.

The answer lies in the ceilings, walls and overhead structure of the plant itself which, properly painted, provide an "indoor sky." In 99 plants out of 100 this means WHITE paint, for efficient lighting requires maximum reflection *and white reflects far more light than any other color.*

For nearly half a century, in every type of industrial plant, BARRELED SUNLIGHT whites have been helping to make good lighting better. For further data on the partnership of Light and Paint in creating good seeing conditions, send for free copy of "Light and Color in the Work-World."



U. S. GUTTA PERCHA PAINT COMPANY
14D Dudley Street, Providence 1, R. I.

I'd like to know more about the partnership of Light and Paint. Please send me your free 32-page booklet, "Light and Color in the Work-World."

COMPANY .....

STREET AND NUMBER .....

CITY ..... ZONE ..... STATE .....

MY NAME IS .....

MY TITLE .....

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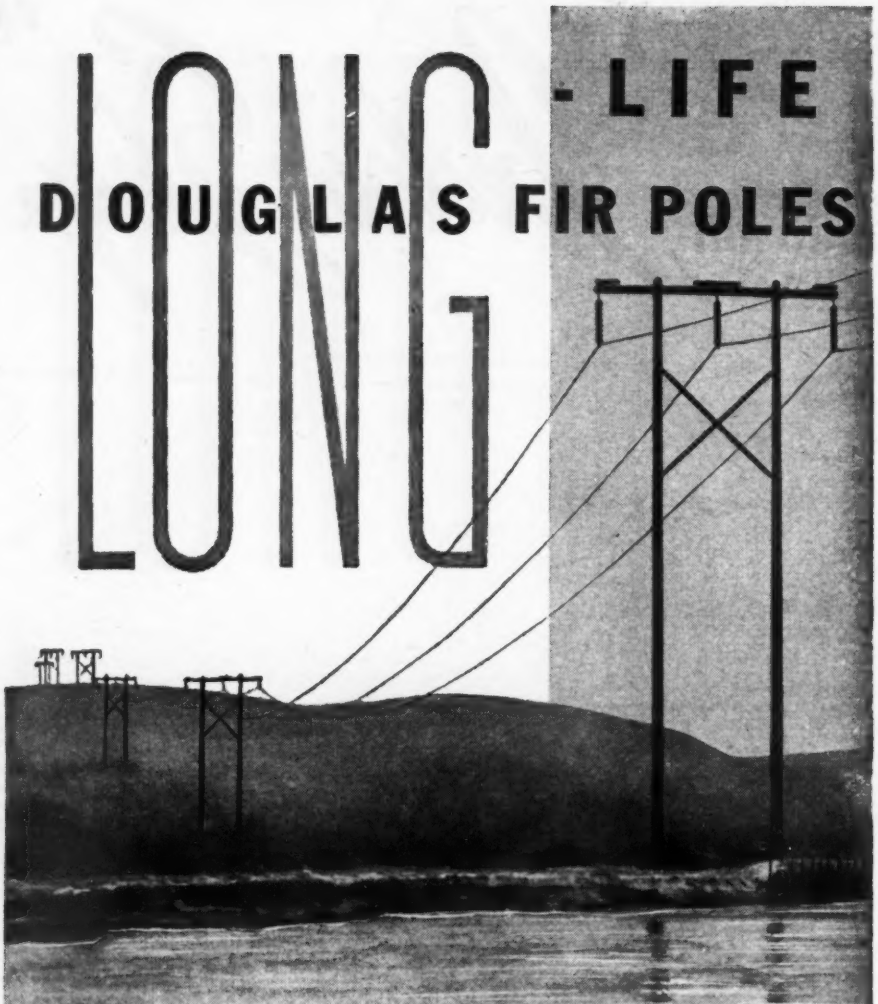
LONG-LIFE
DOUGLAS FIR POLES



Our specialty is long-length Douglas Fir poles, pressure treated for Long-Life service. Prompt shipments of reasonable quantities can now be made in most lengths from 60 foot to 125 foot. Direct rail shipments out of our treating plant stocks can be made to any point in the United States. Write or wire us your inquiries.

Pressure treated Douglas Fir poles have been for years the standard in pole line construction on the West Coast. Our Long-Life Douglas Fir poles meet ASA Specifications and are pressure treated with coal-tar creosote or creosote-pentachlorphenol solution by the empty cell process, 8-lb. retention, in accordance with AWPA Specifications.

Long-Life Douglas Fir poles, pressure treated from high quality Coast-type timber, will cut your maintenance costs and yield longer and more satisfactory service.

Also Produced by J. H. Baxter & Co. of Oregon—*an associated company*
Plant and Yard—Eugene, Oregon

J. H. Baxter & Co.

333 MONTGOMERY STREET · SAN FRANCISCO 4, CALIFORNIA
LOS ANGELES · LONG BEACH · ALAMEDA · CALIFORNIA, U. S. A.

approximately 5½ ft. square and 3 ft. thick. Each of the six arms is 14⅔ ft. long. Center pole rotates at 3 rpm., providing a walk at a rate of 300 ft. per min. or 3½ miles per hour. The rope by which the animal is attached to the arm is long enough so that it follows a circle of about 16-ft. radius. This accounts for the 300-ft. per min. rate of walking.

This equipment is used to break young heifers and train them to lead. It is also used to provide compulsory exercise for bulls and show animals by causing them to walk continuously until the operator brings the device to a stop. Rotary motion of the exerciser will stop in case an overload occurs.

•

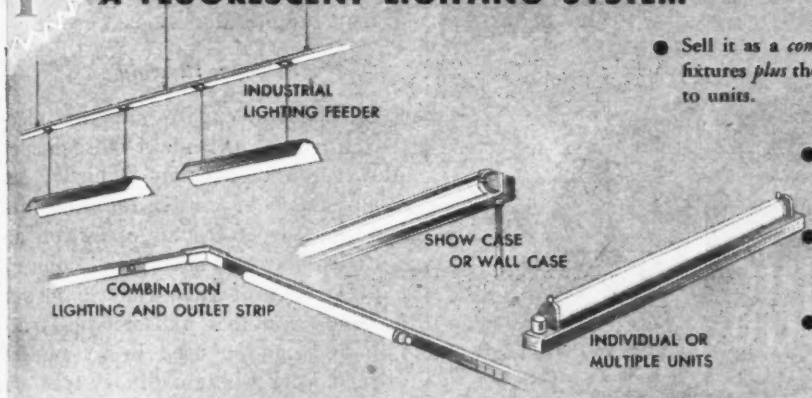
Russians Develop Electric Farm Tractor

ELECTRIC TRACTION in agriculture is becoming a concrete prospect for Soviet collective farmers with the machines being put through their field tests and orders placed for the first trial lots, McGraw-Hill World News reports. At present the use of this type of tractor on Central Asian cotton plantations is also being studied and a special-duty model for truck gardens is being designed.

The experimental machines which have successfully passed lengthy preliminary tests were built by the Moscow Institute for Mechanization and Electrification of Agriculture according to designs by P. P. Listov and V. G. Stetsenko. Their initial model was first used eight years ago and was fairly well along in development by the beginning of the war, during which field work was suspended.

The electric tractor is mounted on an ordinary Stalingrad or Kharkov chassis with ordinary transmission and traction gear. The 54-hp. electric motor is fed by a 750-meter (2,460-ft.) cable rolled on and paid out from a drum installed on the machine. A feed cable of this length enables the

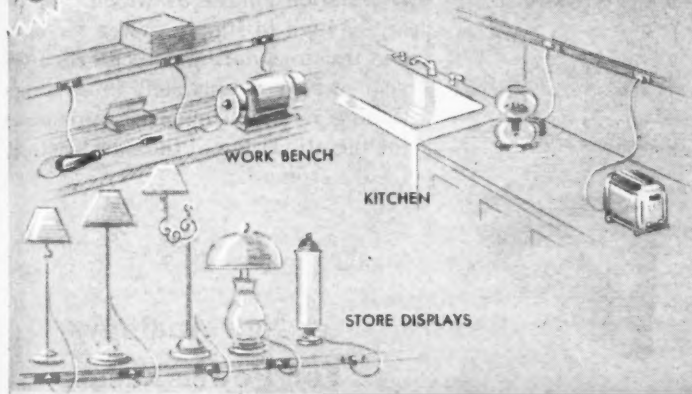
1 A FLUORESCENT LIGHTING SYSTEM



- Sell it as a *combined* feeder raceway, and suspension for lighting fixtures *plus* the economy and convenience of plug-in connections to units.
- Sell it to span beams in factory and commercial buildings.
- Sell it as a show case, wall case or special purpose fluorescent lighting strip with or without reflectors.
- Sell it as a combined outlet and lighting strip in kitchens etc.

ASK FOR DATA SHEET

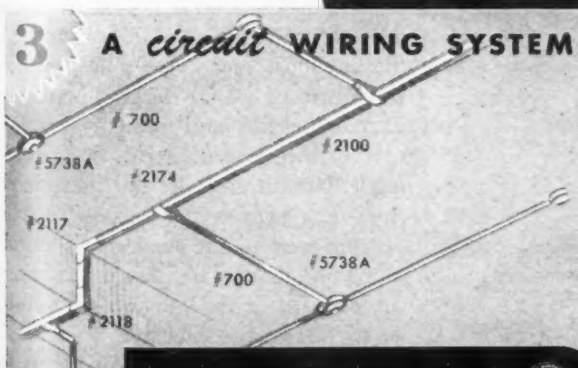
2 A PLUG-IN-ANYWHERE *convenience* WIRING SYSTEM



- Sell it for plug-in-anywhere convenience in homes, offices, schools, hospitals, hotels etc. . .
- *"All* the outlets desired *exactly* where they're *needed"*
- Sell it to industries for work benches, laboratories, test racks, etc. . .
- Sell it to department stores for display areas.
- Sell it to architects, builders, housewives . . . the highest expression of ADEQUATE WIRING.

ASK FOR DATA SHEET

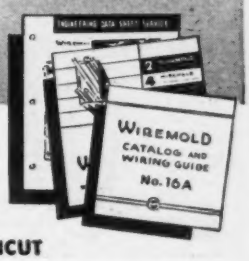
3 A *circuit* WIRING SYSTEM



- SELL it to building management and to industry as an ideal "mid-size" circuit wiring channel.
- Interconnects with all other Wiremold Systems and with existing wires.
- Listed by U. L. with all necessary fittings for complete installation.
- Conveniently and economically Spans Beams.
- Hanger fittings 2108 A and 2108 D meet all needs.

ASK FOR DATA SHEET

Know your WIREMOLD
.... MORE THAN ADEQUATE WIRING



Wiremold Engineering Data Sheets and other literature are designed to help solve wiring problems. If you are not receiving this literature, send us your name TODAY.

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SILV-A-KING
Lighting Equipment
A complete line of quality lighting units from a single source.
COMMERCIAL
INDUSTRIAL
FLUORESCENT
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SILV-A-KING lighting equipment has been incorporated in major installations, throughout the country, for over a quarter-century . . . a tribute to craftsmanship . . . to modern manufacturing methods . . . to a continuing program of research into every phase of illumination.
SILV-A-KING Lighting Equipment is sold exclusively through recognized electrical wholesalers.
SILV-A-KING LIGHTING EQUIPMENT
BRIGHT LIGHT REFLECTOR CO. INC.
subsidiary of
BRIDGEPORT PRESSED STEEL CORP.
Bridgeport 5, Conn.
RLM

tractor to work a strip a kilometer and a half in width all along the power line supplying the current. The speed ranges from 4.4 to 6.2 km. (2.7 to 3.9 miles) an hour, with productivity at an average of 8/10 to 1 hectare (2 to 2.5 acres) of plowing an hour. Power consumed per hectare of plowing is 45 kw.-hr. (18.6 kw.-hr. per acre). The first experiments in electrical plowing were made in the Crimea and then in the Volga area, where portable transformer substations fed from nearby high-tension lines were used.

Deeper Plowing

Agricultural experts say that electric traction will make for deeper plowing and greater efficiency at other stages of cultivation. Besides cutting costs of tractor operation almost by half and saving the country a great deal of fuel, electric power provides smoother and steadier traction and can be used in all phases of field work where ordinary tractors are now employed.

The projected construction of tens of thousands of collective farm electric stations, most of which will be big enough to supply power for electric traction, during the current five-year period to augment those functioning now will open big prospects for the utilization of the new tractors, Listov stressed.

•

A New Analogy For Power Factor

NUMEROUS ANALOGIES have been devised to explain power factor to the lay customer. Of those in the repertoire of D. O. Bergey, manager of commercial and industrial sales of Northwestern Electric Co., Portland, Ore., the "oil and gasoline" story has proven the easiest avenue of approach to the customer's mind in trying to explain this mystifying subject. It goes somewhat as follows.

The utility furnishes two commodities to every customer having motors. One is the energy, measured in kilowatt-hours, that the motor transforms into work. The other is the magnetizing current taken by the motor, and without which it will not operate. It is just like the two commodities, gasoline and oil, required to make an

TROUBLE-FREE FLUORESCENT FOR HOME LIGHTING...

thanks to Certified Ballasts!

PORTABLE lamp makers are becoming increasingly aware of the importance of proper auxiliary equipment to get best results from the circular fluorescent tube. For on this auxiliary equipment—the BALLAST—depends the success of fluorescent portable lighting in the home.

Be sure, therefore, that the lamps you make or sell are equipped with CERTIFIED BALLASTS—*for the protection of your customers . . . and yourself.*

CERTIFIED BALLASTS, installed properly, prevent excessive heat—thus avoiding the risk of injury to table tops and floor coverings. CERTIFIED BALLASTS are free from distracting noise. They make satisfied customers.

WHAT DO WE MEAN BY "CERTIFIED"?

"CERTIFIED" on a ballast means that it has been built to exacting specifications set up by leading engineers—for use in a portable lamp. "CERTIFIED" means that nationally famous Electrical Testing Laboratories, Inc., continually tests and checks the product against these specifications... give it the stamp of approval. And CERTIFIED BALLASTS have long been the accepted standard in commercial and industrial fluorescent lighting. They're your best assurance of dependable performance . . . and customer good will.

•

Certified Lamp Makers have solved their ballast problems by writing CERTIFIED BALLASTS into their specifications.

CERTIFIED
E·T·L·
SPEC. NO. 6
HIGH PF

CERTIFIED BALLAST MANUFACTURERS

Makers of Certified Ballasts for Fluorescent Lighting Fixtures

Acme Electric Corporation
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Starring and Company
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Wheeler Insulated Wire Co., 378 Washington Ave., Bridgeport, Conn.

Don't Fiddle with Fire!

Get the ALL FIVE RANDOLPH Trigger-Touch Extinguisher!

1. EASE—One-hand operation, from bracket to fire. Randolph "4" means panic-proof protection

2. SPEED—Tests prove Randolph trigger-touch "10" stops 2-gallon gasoline fire in 10 seconds

3. SAFETY—Randolph CO^2 will not conduct electricity. And it's non-toxic . . . there's no danger from any poisonous fumes

4. NEATNESS—No mess or stain . . . no water or chemical damage with a new Randolph CO^2 trigger-touch extinguisher

5. EFFICIENCY—Randolph is ready for action under all temperatures. You have no freezing or deterioration to worry about

Randolph Extinguishers give you a truly great combination of features for full protection against most industrial fire hazards. Guard your property with the right extinguisher . . .

Send today for new free data guide to help you choose proper protection. ***Approved by Underwriters' Laboratories.***

RANDOLPH LABORATORIES, INC.

10 E. Kinzie Street Chicago 11, Illinois

automobile run. The gasoline furnishes the energy and is comparable to the kilowatt-hours. The lubricating oil, like the magnetizing current in the electric motor, is necessary to make the engine operate.

Pays Only for "Gasoline"

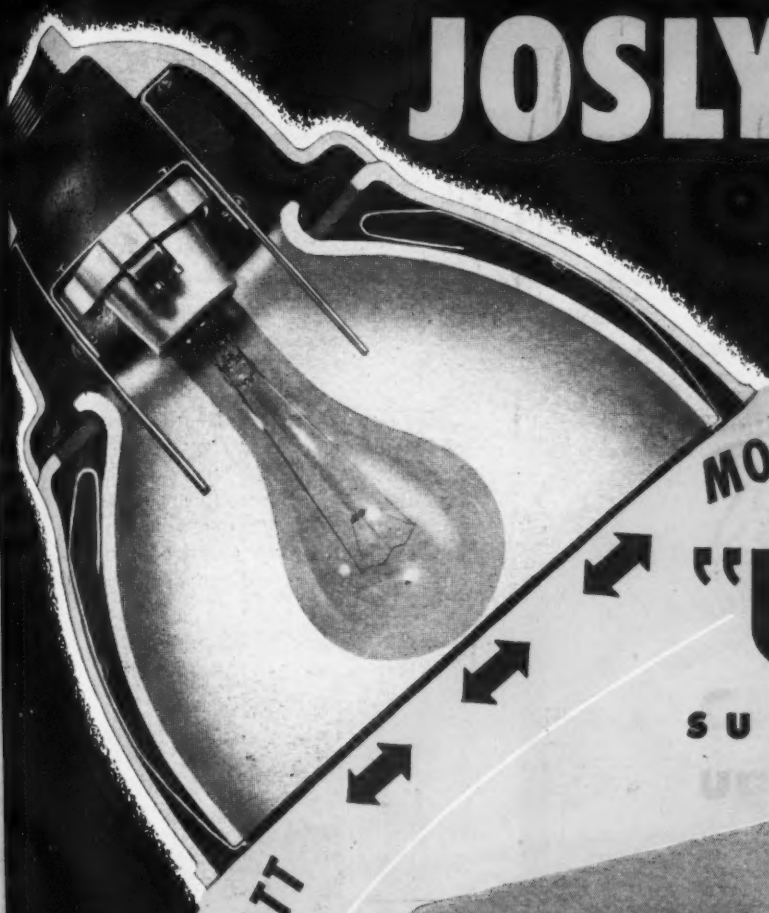
The service station measures both commodities, gas and oil, and there is a unit price on each. The customer pays for the exact amount of each he uses. Unfortunately, in the power business, frequently only the energy, or "gasoline," is metered and charged for. Yet, the "lubricating oil," or magnetizing current, costs the power company money in added investment in larger generators, wires, transformers and substations, to produce and deliver it.

"Oil" Cost Getting Heavy

The power salesman goes on by saying, "The situation is simply this —conditions have gotten so bad that a good part of our investment serves no other purpose than to supply the 'oil' or magnetizing current requirements. This is inequitable and unfair to you as a power customer because you may be helping to pay for the 'oil' another fellow is using. Therefore, with Public Service Commission approval, we have had to limit the magnetizing current each customer can draw to a nominal amount, beyond which we must make an extra charge. This limitation has been set at what we call 85 percent *power factor*. And by power factor we mean this—if the oil and the gasoline were fed to the automobile engine through the same pipe, it would be the proportion of gasoline to the total flow in the pipe, expressed as a decimal fraction or as a percentage. In other words, it is a *multiplier* or *factor* by which the total current flowing in an electrical circuit can be multiplied to determine the proportion that is energy current. The remainder is magnetizing current, which is the 'oil' we have been talking about. By making a charge for this 'oil' above the nominal amount indicated by 85 percent power factor, we assure that the customer who uses too much will pay for it."

Then the salesman tells how power factor can be held to 85 percent and excessive use of "oil" avoided by proper loading of induction motors and by installation of synchronous motors and capacitors.

JOSLYN *gives you*



MORE USEFUL LIGHT PER WATT

WITH THE

"UTILUX"

SUBURBAN LUMINAIRE

TYPE K

USEFUL LIGHT PER WATT

1 **REFLECTOR**
Special high strength glass
Specular sealed-in reflecting surface
Cannot tarnish or corrode

2 **HOUSING**
Cast aluminum
Supports reflector
Prevents damage

3 **CUSHIONED MOUNTING**
Phosphor bronze springs
Reflector snaps in and out of locked position
Automatically positions on light center

4 **HEAD**
Cast aluminum
Inner or outer wiring
Pipe thread or clamp mounting

5 **SOCKET**
Medium multiple
Calibrated adjustable support bracket
For 200 watt lamps or smaller

offices in principal cities

•

THE JOSLYN CO.
SOUTH EAST-JOSLYN CO.
NORTHERN JOSLYN CO.
JOSLYN SOUTHWEST CO.
JOSLYN COMPANY OF CALIFORNIA
ROGERS SUPPLY CO.

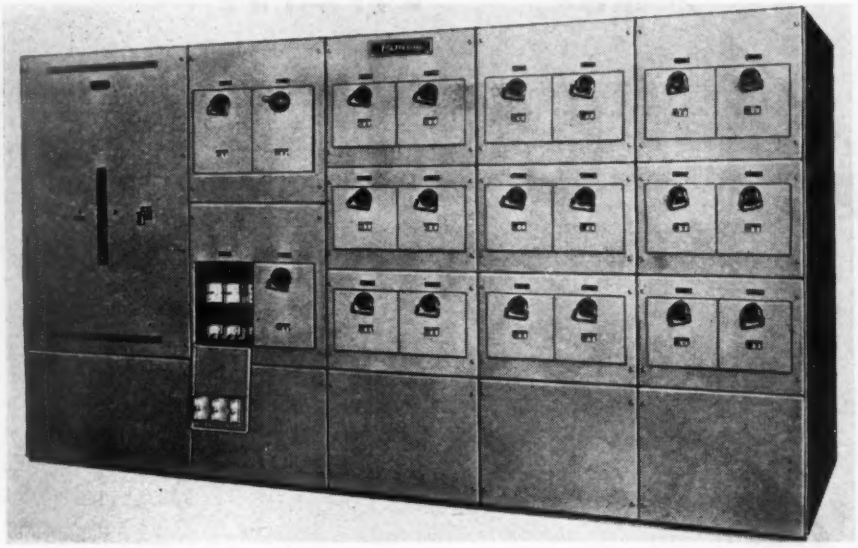
JOSLYN MFG. AND SUPPLY CO.

Complete Pole Line Equipment

20 NORTH WACKER DRIVE, CHICAGO 6, ILL.

NEW EQUIPMENT

Panel Safety Switch Component Standardized

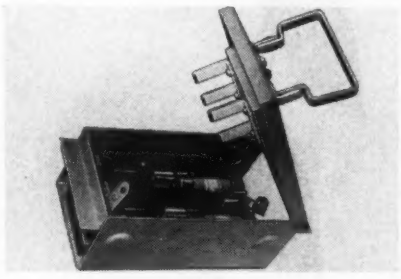


A "ROTA-SWING" switch with ratings up to 600 amp. at 600 volts for use on dead-front panels and switchboards has been announced by Pelham Electric Mfg. Co., Erie, Pa. The switch is so designed that the opening of the door automatically deenergies exposed parts.

While the switch is disconnected, the rotation of the handle moves the knife blade from "off" to "on" position, or vice versa. Steel guides are stated to hold blades in alignment.

The new design is reported as suitable for heavy-duty power and light applications, and can be obtained in ranges between 0 and 600 amp.; 250 volts d.c. to 600 volts a.c.; and in 2, 3, or 4 pole types.

It is reported that changes in fuse gaps can be made at any time and that mounting plates, steel compartments



and bus bars have been standardized, so that provision for future expension can be made in the board or panel.

• • •

Portable Induction Heaters Stacked for Added Capacity

A NEW portable induction heater manufactured in units of 10 kva. for preheating and normalizing for welding has just been announced by Electric Arc., Inc., 44 Jelliff Ave., Newark 8, N. J., manufacturers of Smith-Dolan low-frequency induction heating equipment.

The new Model UP Induction Heater was developed primarily for its flexibility and adaptability to a wide range of applications and capacities, the manufacturer reports. The individual units of 10 kva. each may be stacked on the job to form groups of two and three units with capacities of 20 and 30 kva. The 30-kva. group, for instance, is capable of preheating a 10-in. pipe joint to 1,300 deg. F. in two hours, it is stated.

Each unit is complete in itself, containing power unit, contactor, meters and control supply. Heating current and voltage output variations are brought about by selector switch built into the unit. Controlling pyrometers and program controllers can be plugged into the unit in two polarized receptacles for recording job temperatures and

heat cycles. Polarized receptacles are also provided for the interconnection of the heater into groups and for the power supply to the units.

The unit also can be used for thawing large water lines, testing high current power bus connections, testing current transformers, supplying phantom loads for testing relays on power systems, resistance heating for brazing and soldering, shrink-fitting, heating for straightening, drying water soaked rotors and stators and many other such uses, it is stated.

•

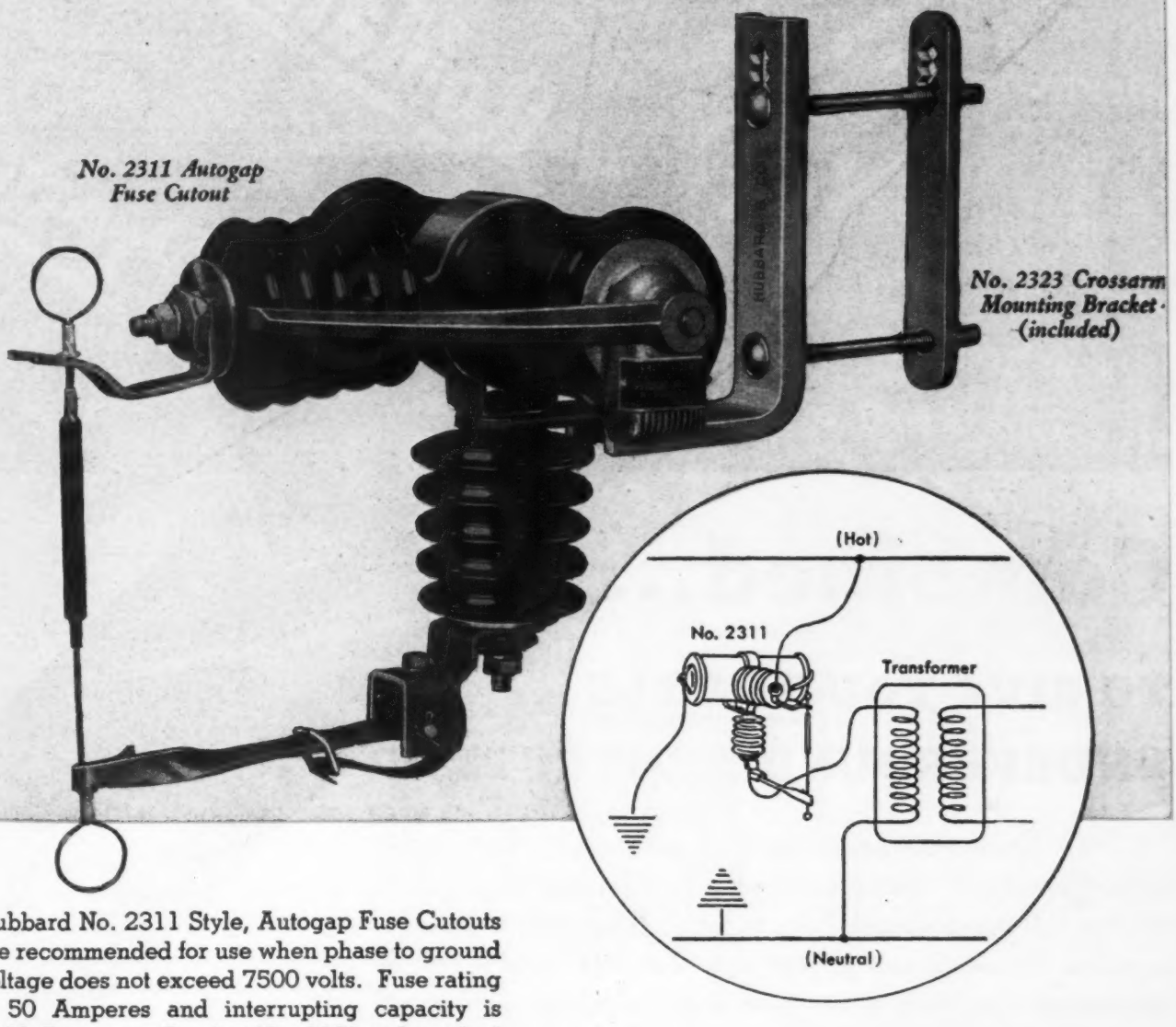
Resistance Welding Controls Available as Package Unit

A LINE of synchronous-precision, a.c. resistance welding controls in a complete, factory-assembled package is announced by Westinghouse Electric Corp., Buffalo, N. Y. Key to the new Synchro-Trol are the eight factory-assembled subunits and the five supplementary subunits from which it is possible to make hundreds of combinations for timing and sequencing. It may be side-of-welder or floor mounted.

The finger tip control is utilized. A

HUBBARD AUTOGAP FUSE

A combination of the No. 2302 Hubbard Autogap Arrester with a 7½ K.V. dropout Fuse



Hubbard No. 2311 Style, Autogap Fuse Cutouts are recommended for use when phase to ground voltage does not exceed 7500 volts. Fuse rating is 50 Amperes and interrupting capacity is 1200 Amperes. Bracket No. 2323 is furnished for cross arm mounting and No. 2325 for pole mounting. Type of Bracket must be specified when ordering as one type only is included. Special brackets can be furnished. Fuse links are not included.

This new Hubbard open link type of cut-out is built around the sturdy and efficient Autogap No. 2302 with the fuse mechanism added. It has the same highly rated moisture proof, long-life Autogap qualifications that are so widely accepted by engineers throughout the power field. It is approved by R.E.A. and will be displayed at Hubbard Booth No. 8 at the National Rural Electric Cooperative Association Convention at Spokane, April 22-25. Ask to see it and don't miss the miniature Hubbard Autogap in action.

HUBBARD and HUBBARD COMPANY

Pittsburgh *Chicago*

Oakland, California

Combined...

TO GIVE YOU *DOUBLE* UNDERGROUND PROTECTION

Developed primarily for direct earth burial or duct service, RoMarine-RoPrene combines a superior moisture resistant insulation with the well known durability of a Neoprene jacket. Here is a *double* protection. You get an underground cable of high electrical stability in the presence of moisture, with long life, as well as resistance to oils, soil acids and alkalies, and other corrosive elements. Unaffected by sunlight and oxidation, it possesses superior weathering properties . . . If it's going underground, remember RoMarine for high quality, low water absorption, insulation . . . and RoPrene for rugged, long life sheath protection. Combined, they assure a long service life of dependable operation.

Easy to handle and splice, RoMarine-RoPrene is the answer to your lead sheath problem.

FROM BAR TO FINISHED WIRE

ROME CABLE CORPORATION

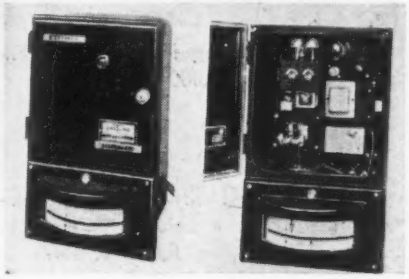
ROME • NEW YORK

transparent access door protects control setting against tampering. Inspection is simplified through a front access door and a swing-out feature of the cabinet provides access to the rear. Subunits are of the pull-out type and may be removed for changes in control requirements by unloosening two wing nuts and disconnecting the plug connectors.

•

Features of Two Instruments Incorporated in Single Unit

A NEW temperature control instrument, the Xactline Capacitrol, combining the features of the company's



Xactline control unit and Wheelco Instrument Co.'s electronic principle Capacitrol, has been announced by the Claude S. Gordon Co., 3000 South Wallace St., Chicago 16, Ill.

The new unit is said to anticipate temperature changes and to hold variations within 1/5 of a degree F. Utilizing the electronic control principle, it is completely electrical in operation. It has a separately enclosed instrument with a direct reading indicating scale.

It is available in two distinct models for varying requirements. Hookup for operation is identical to that of the standard model No. 244 Pyrometer Controller. The unit is available for flush or surface mounting.

•

Connector Makes Splice Which Does Not Loosen

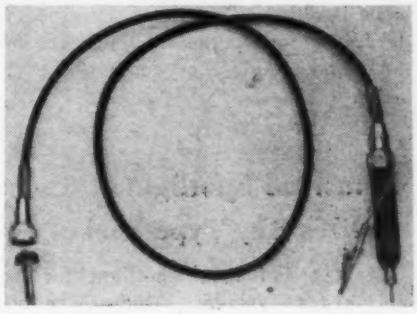
PIGTAIL SPLICES which will not loosen under continuous vibration are reported made by the new AMP closed-end connector manufactured by the Aircraft Marine Products, Inc., 1595-1 North Fourth St., Harrisburg, Pa. Furnished with the insulation already attached, the connector is said to make a permanent, insulated splice with a single operation of a hand tool without the necessity of soldering, wire twisting, or taping. The insulating sleeve extends beyond the metal barrel of the connector and covers the protruding ends of the wire insulation.

Miniature Rectifying Probe Tests VHF Circuits

A NEW miniature crystal rectifying probe, has been developed by the Radio Corp. of America, which, it is reported, adapts the company's VoltOhymst and Chanalyst for circuit testing of television, frequency modulation, and other VHF applications within the sensitivity ranges of these instruments.

The new probe, Type MI-8263, has a germanium crystal to rectify applied a.c. voltages which are then measured by the d.c. circuit of the meter. The meter reading is proportional to the positive peak of the applied a.c. voltage. The company reports good linearity is obtained with the probe, and also, because of its low input capacity and high impedance, this accessory is especially suited for accurate reading without regard to load resistance.

Designed to facilitate testing in difficult places, the probe has a long,

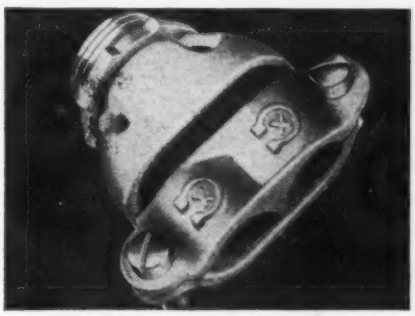


narrow point. Its body is constructed of insulating material and reinforced at the end with a metal shield to eliminate capacity effects when held for testing. A detachable ground lead with an alligator clip is provided for use at the highest frequencies, where the lead length becomes a factor in over-all accuracy.

• • •

Connector Accommodates New Code-Approved Cables

A NEW duplex connector, designed for the new code PVX armored and nonmetallic cable, has been announced by



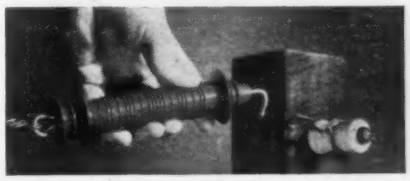
Gedney Electric Co., RKO Bldg., New York 20, N. Y. Called the DC-15, it accommodates the full range of cable sizes from two-conductor No. 14 to three-conductor No. 10. A two-screw clamp is utilized to squeeze and thereby support the cable.

•

Electric Fence Gate Is Shock Free

A NONCONDUCTING, weather-resistant plastic, electric-fence gate handle has been announced by the Accessories Manufacturing Co., Inc., Kansas City, Mo. Molded of Tenite with ridges on its surface and with stops on either end, the gate is said to be shock-free in wet as well as dry weather.

A compression spring encased in the

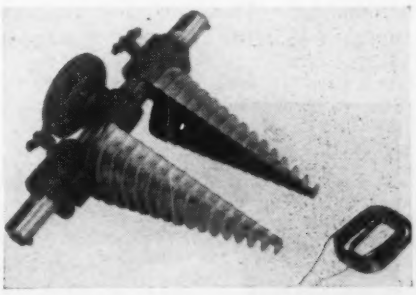


plastic handle maintains the contact between the two ends of the fence wires which the gate connects.

•

15 Equally Spaced Steps On New Coil Winding Head

AN IMPROVED concentric coil winding head, Type SPO, has been developed by Potter & Rayfield, Inc., P. O. Box



1042, Atlanta, Ga. The winding forms are polished aluminum castings and are fitted on a 1 3/8x18-in. splined bar, which is equipped with a 5-in. flange and threaded hub. Each form has 15 equally spaced winding steps and each step increases the coil dimensions 3/8 in. in span and 1/8 in. in length.

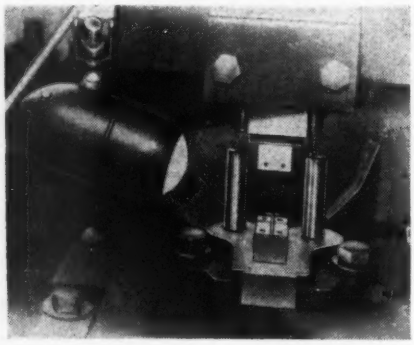
This unit will wind a coil having a square nose and straight slot section,

which is reported to have advantages in winding motors where end bell clearance is close. The unit is designed to form coils for fractional-horsepower motors and single-phase motors up to 5 hp.

•

Industrial Spotlight Utilizes Key Type Socket

A NEW industrial spotlight for use on bench grinders, lathes, punch presses, riveters and other machines or operations where a high degree of il-



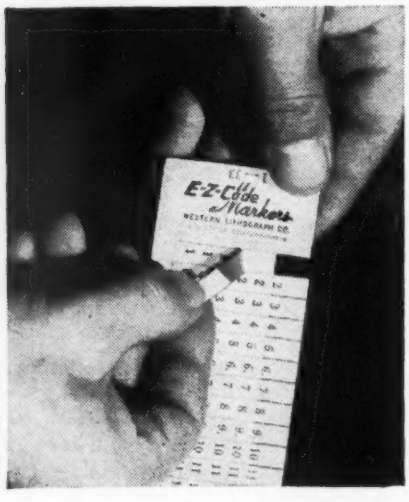
lumination and contrast is required, has been developed by the Maine Electric Co., Inc., 1462 East Main St., Rochester 2, N. Y.

The front end of the shell contains a lens which concentrates the light. Louvers, both top and bottom, are provided for ventilation.

•

Wire Coding Markers Don't Stick to Fingers

NEW FEATURES incorporated in the Western Lithograph Co.'s, Los Angeles 54, Calif., product E-Z-Tab are stated to make wire coding faster and more economical. The tabs are available mounted on cards to prevent damage in shops.



Pressure Cooker Built In New Model Electric Range

A BUILT-IN 6-qt. pressure cooker and a 4,200-watt boiler unit are included among the features in the Stratoliner, the General Electric 1947 range. Other ranges for the medium and low-price market will soon reach the market.

The built-in aluminum pressure cooker occupies the deep-well position. The pressure cooker utensil may also be used on a surface unit; or when the flat lid, which is provided, is substituted for the pressure lid, it serves as a conventional thrift unit for normal cooking.

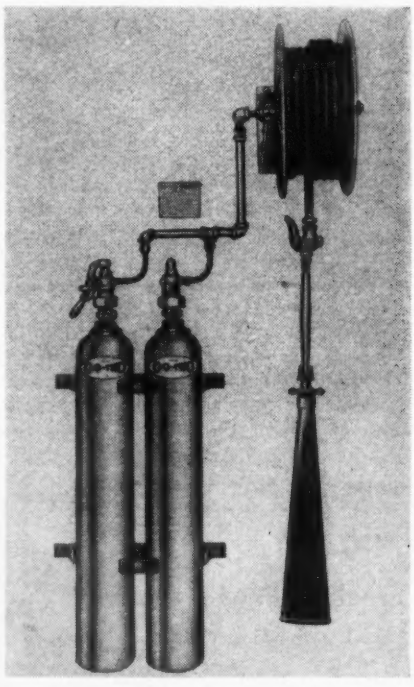
Like the other ranges in the line, the Stratoliner has two 5-speed, 6-in. surface units rated at 1,250 watts, and a 5-speed, 8-in., 2,050-watt surface unit. The company reports the broiler power was increased 75 percent by widening the

unit and increasing its wattage. The bake unit draws 3,000 watts.

• • •

Chrome-Plated Brass Reel Developed for CO_2 Hose

A NEW and improved lightweight hose reel of the shock-proof type for carbon dioxide systems, available in capacities from 50 to 200 lb. or more of carbon dioxide, has just been announced by



the C-O-Two Fire Equipment Co., Newark 1, N. J. This stamped brass and chrome-plated hose reel may be fitted with ½-in. high-pressure hose of any length up to 125 ft. or any length up to 100 ft. of ¾-in. hose, the manufacturer reports.

The hose reel and discharge horn may be installed adjacent to the gas cylinders or at a remote point. The handle of the fire fighting nozzle is equipped with the company's "squeeze-grip" valve for controlling discharge of the carbon dioxide gas when working around a fire.

•

Outdoor Safety Switch Has Slanted Roof

A new weather-proof safety switch, for use in outdoor applications and other locations where adverse atmospheric conditions prevail, has been developed by the Electric Controller & Mfg. Co., 2700 East 79th St., Cleveland 4, Ohio. It is made in both single and double door styles, with ratings from 30 to 600 amp. up to 575 volts a.c., and 2, 3 and 4 pole types.

Known as Bulletin 1300 Weatherproof Safety Switches, they are a type A switch and reported as rain and dust-tight in construction. Enclosures are heavy gauge steel with aluminum finish and have a slanted roof with drip-trough over the front door. A sponge rubber gasket is utilized to make the tight seal between the box and the door.

The switch-mechanism is fully interlocked to prevent opening the door with the switch in the "on" position, in both single-door and double-door types. Single-door is standard for most sizes with double-door construction optional. Interlocking is obtained on the inner door of the double-door types. Provision is made for padlocking switch open and also for padlocking door closed.

Dig Holes Faster! Cut Your Costs! with JAQUES EARTH BORING MACHINE

SPECIFICATIONS

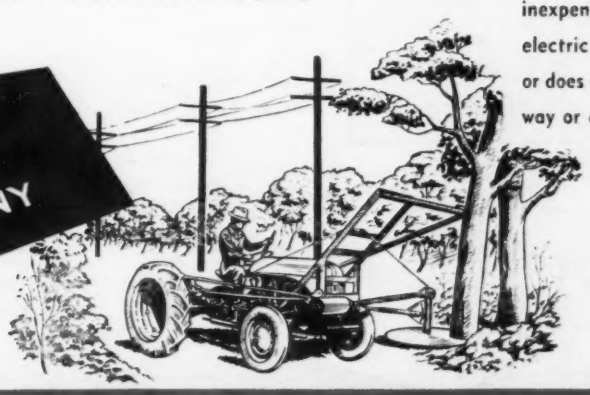
1. GENERAL: Self-contained unit mounted on steel I-beam skid. Can be easily attached to and removed from truck or other conveyance. Can be mounted on crawler-type tractors at factory.
2. ENGINE: Standard make, 8-cylinder, 100-hp., gasoline motor, equipped with generator, battery, and self-starter.
3. DRIVE: Mechanical; standard truck parts used in right angle drive and final drive; 4 speeds forward, 1 speed reverse.
4. DIGGER SHAFT: Steel, 2¼" x 2¼" x 13'-1".
5. CONTROLS: Hydraulic control system governs raising and lowering of digger shaft and leveling and driving of the auger; hydraulic power furnished by La Plante Choate Pump.
6. WORKING PRESSURE: 850 to 1,000 lbs. normal working pressure, governed by automatic relief valve.
7. HOLE SIZE: 9" to 30" diameter; up to 8½' depth.
8. ATTACHMENTS: Earth bits, clay bits, sand bits, rock bits, frost bits, and expanding reamers.
9. WORKING WEIGHT: 3,440 lbs. (with 16" bit).
10. DIMENSIONS: Width, 4'-3"; length, 10'-0"; height, 4'-9" in traveling position, 12'-6" in working position.
11. SHIPPING DATA: Crated for domestic shipping, weight 3,640 lbs. (1 crate 156" x 54" x 72"); boxed for export, weight 6,100 lbs. (1 box 163" x 65" x 72", 442 cu. ft.)

HYDRAULIC CONTROL

Designed to out-perform and outlast competitive machines, the JAQUES EARTH BORING MACHINE is a great unit if there ever was one! With its own auxiliary motor, giving ample power for any job, it can be mounted on a truck or crawler tractor. Can be used on rough terrain, and hydraulic controls give instant leveling and plumbing. One man easily handles all hydraulic controls. Bores hole 20 inches across and 8½ feet deep in less than two minutes. Auger bits are made in sizes up to 30" diameter. Write for descriptive literature giving full data.

JAQUES POWER SAW
Quickly Clears Right-of-Way

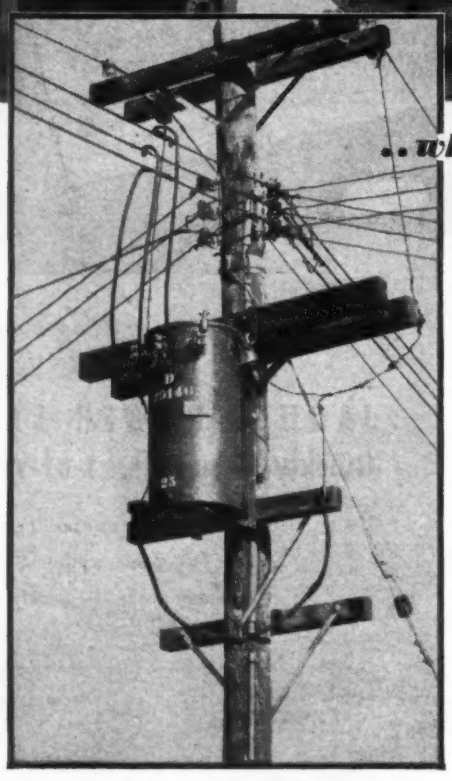
The tractor-mounted Jaques Power Saw clears brush and trees like mowing hay. It quickly and inexpensively clears a channel for electric power and telephone lines or does any other kind of right-of-way or clearing job.



JAQUES
POWER SAW COMPANY

HIGHWAY 75 DENISON, TEXAS

JAQUES
PRODUCTIVE POWER EQUIPMENT
is the Source of



...whether Your Power Problem is Large or Small

a Wagner Transformer Can Solve It!

MIDGETS on poles—Giants in Power Plants—Wagner Transformers are giving account of themselves by maintaining continuity of service. They keep the lights burning in homes . . . They keep the wheels of industry turning with unfailing dependability that has made Wagner Transformers world famous.

Whether your power problem is large or small—Wagner can furnish the transformer that will give you the solution. Users of Wagner transformers also profit by our quick, convenient, nation-wide service facilities.

Fifty years of experience and knowledge, gained in furnishing transformers of all sizes and types, stands behind every Wagner product. Twenty-nine branch offices manned by trained field engineers are ready to serve you.

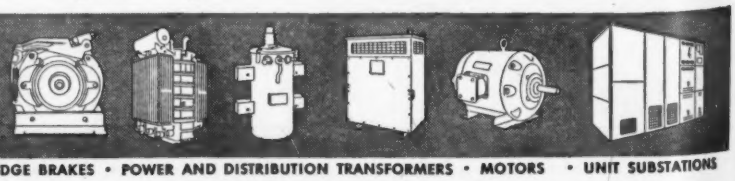
Write for Bulletins TU-180 and TU-181

Address Wagner Electric Corporation, 6456 Plymouth Avenue, St. Louis 14, Mo. for these valuable Bulletins on the complete line of Wagner Transformers.

T47-4

Consult Wagner Engineers on All Transformer Problems

Wagner Electric Corporation EST. WE 1891



BRIDGE BRAKES • POWER AND DISTRIBUTION TRANSFORMERS • MOTORS • UNIT SUBSTATIONS

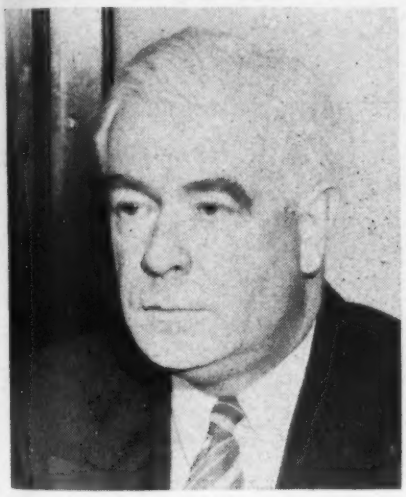
ELECTRICAL AND AUTOMOTIVE PRODUCTS

NEWS ABOUT PEOPLE

Union Electric Co. Elects Brennan Vice-President

Vincent C. Brennan, who joined the Union Electric Co. of Missouri in 1942 as executive director of personnel, has been elected vice-president in charge of personnel, a newly created position.

Prior to his association with the St. Louis utility, he had been in charge of



V. C. BRENNAN

personnel and industrial relations at the Tidewater Associated Oil Co., Bayonne, N. J. He is a member of the industrial relations committee of Edison Electric Institute.

•

▶E. LABADIE has been appointed service manager of the Progressive Welder Co., Detroit.

▶JAMES P. DEMPSEY has been appointed production manager of the West Lynn, Mass., Works of the General Electric Co.

▶HOWARD SALABANK has been named acting superintendent of the Norwalk, O., municipal light and power department, replacing M. G. Irvin. Salabank has been chief engineer for the past 28 years.

▶K. A. MUNSON, who began work with the General Electric Co. at Lynn, Mass., in 1912 as a drafting apprentice, has been appointed general superintendent of the River Works at Lynn. C. H. WILKINS, assistant superintendent, has been appointed superintendent of the general maintenance and plant engineering division; and A. T. COMSTOCK has been named supervising engineer of power plant, electrical distribution, test equipment and telephones, both at the River Works.

•

Eastern Shore Announces Changes in Managerships

Eastern Shore Public Service Co. has announced three changes in the district managership of its offices.

J. L. Disharoon, district manager in Millsboro, Del., has been appointed district manager at Salisbury, Md., to succeed J. R. Wilson, recently advanced to manager of the Cambridge Division.

Wesley Bullock, manager at Crisfield, Md., will succeed Disharoon at Millsboro.

C. A. Turner, local supervisor in Cambridge, Md., has been advanced to the managership at Crisfield.

•

▶ERNEST W. HILL, vice-president of Electric Power & Light Corp., has retired from the position which he held since 1935. At one time he was treasurer and later vice-president of the Electric Bond & Share Co.

▶PAUL C. YELTON, formerly San Bernardino district manager of the California Electric Power Co., has been made construction engineer, replacing E. J. Waugh, who has retired after 25 years of service.

▶S. E. GATES, manager of the Los Angeles General Electric Co. apparatus department, has retired after 42 years with the company and 23 years in his last position. G. F. MAUCHMER, assistant manager, has succeeded him.

▶DAVID BLAIR, JR., has been made general sales manager in charge of all sales and advertising activities of Telechron, Inc., Ashland, Mass.

Dickey and Hammond Now Bailey Meter V.-Presidents

P. S. Dickey, chief engineer, and H. M. Hammond, general sales manager, have been elected vice-presidents

P. S. DICKEY

of the Bailey Meter Co., Cleveland, Ohio.

Dickey, a Purdue University graduate, has been with Bailey since 1925. In 1934, he became chief research engi-

H. M. HAMMOND

neer and in 1940, special consultant on marine problems. He was appointed chief engineer in November, 1944. He is the author of many technical papers on measurement and control and holds numerous patents on automatic control

A paper insulated power cable may seem to consist of nothing more than a copper conductor covered with a few layers of oil impregnated paper and protected from moisture by a lead sheath. It is easy to be misled by what appears to be a simple combination of a few basic materials.

You do not see:

- The careful selection and testing of the paper.
- The purification and inspection of the impregnating oil.
- The thorough drying of the cable under very high vacuum.
- The numerous precautions to insure a lead sheath of uniform quality and thickness.
- The various tests that watch quality step by step during the manufacturing processes.
- The searching electrical tests that assure us and tell you that the completed cable is up to the high Simplex standards, which are way beyond those set by the most rigid commercial specifications.

It is these unseen features that give you the cable from which you can expect the service you need. They should not be overlooked. In the making of Simplex Paper Insulated Power Cables, these unseen but important features receive unusual attention. That is why you should talk with Simplex engineers before you buy Paper Insulated Power Cable.

Simplex - WIRES & CABLES

SIMPLEX WIRE & CABLE CO. 79 SIDNEY ST. CAMBRIDGE 39, MASS.

equipment. Dickey will continue to direct the company's engineering activities and to advise its foreign affiliates on engineering problems.

Hammond graduated from Rensselaer Polytechnic Institute in 1918 and served as a naval officer before becoming a field engineer for Bailey in 1919. He became Philadelphia branch manager in 1921 and sales manager in 1923. Hammond will continue to direct all sales activities of the company.

Kansas not Oklahoma

Charles R. Preston has been made vice-president of Kansas Gas & Electric Co. and not vice-president of the Oklahoma Gas & Electric Co. as stated in the April 5 issue of Electrical World. Any inconvenience caused Mr. Preston or either of the two utilities is greatly regretted.

▶ WILLIAM L. HUNTER, chief engineer, has been named general manager for Northern Equipment Co., Erie, Pa., and has been succeeded by HAROLD A. SCHLIEDER, who has been in charge of foreign engineering for the company. FRANCIS W. BUNTING has been appointed assistant chief engineer.

▶ JOHN H. GANZER, vice-president of the Coolerator Co., Duluth, Minn., has been elected president.

▶ WILLIAM G. ELLIS has been appointed manager of industrial electronics sales by the Radio Corp. of America.

▶ C. A. NASH, director of purchases for the United Light & Railways Service Co. and affiliated companies, Davenport, Iowa, has resigned to assume the presidency of the New World Products Co., Omaha, Neb., distributors of Reynolds Metals Products. Mr. Nash was named new business manager for the Peoples Light Co. in 1918, later becoming a vice-president of the United Light & Power Engineering and Construction Co. until that company was reorganized in 1938, after which his title became sales promotion manager for the United Light & Power Service Co. and its affiliated utility companies. Mr. Nash had a distinguished military record during the recent war. Following V-J Day he became a major, officer in charge of the G. L. Martin Nebraska Co., builders of B-29 superforts in Omaha and termination contracting officer directing the settlement and closing of this large contract and hundreds

IT'S NEW... IT'S DRAMATIC...

FOR LEADERSHIP IN LOAD BUILDING!

The UNIVERSAL "Speedliner" The Nation's Fastest Range... Out in Front by Two Full Years!

It's Completely Automatic!!

Packed with Features for Salesational Selling

1. New Super-Heat Surface Units ...new "Monotube" construction gives tops in efficiency... greatest ease in cleaning.

2. New Mult-I-Heat Control... now you can get any degree of heat desired for surface cooking—pioneered by Universal.

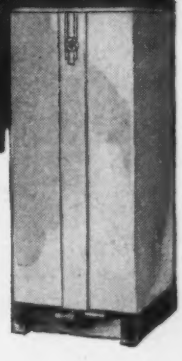
3. New Thermo-Chef Auxiliary Oven... does completely automatic cooking when large oven capacity is not required. Heated by side-wound unit and thermostatically controlled.

4. New Tru-Bake Automatic Oven ... new "push-button" Preheat Switch and new oven-exposed thermostat combine to give even temperature control through successive bakings. Completely automatic with new easy-to-use timer.

5. New Tel-A-Switch Panel with Signalite Control... for easy identification and extra convenience. Ovens automatically switch from preheat to bake.

6. New Automaticook for Completely Automatic Cooking... controlled by Select-A-Trol... amazingly efficient and easy to use... eliminates oven watching.

ALSO UNIVERSAL WATER HEATERS



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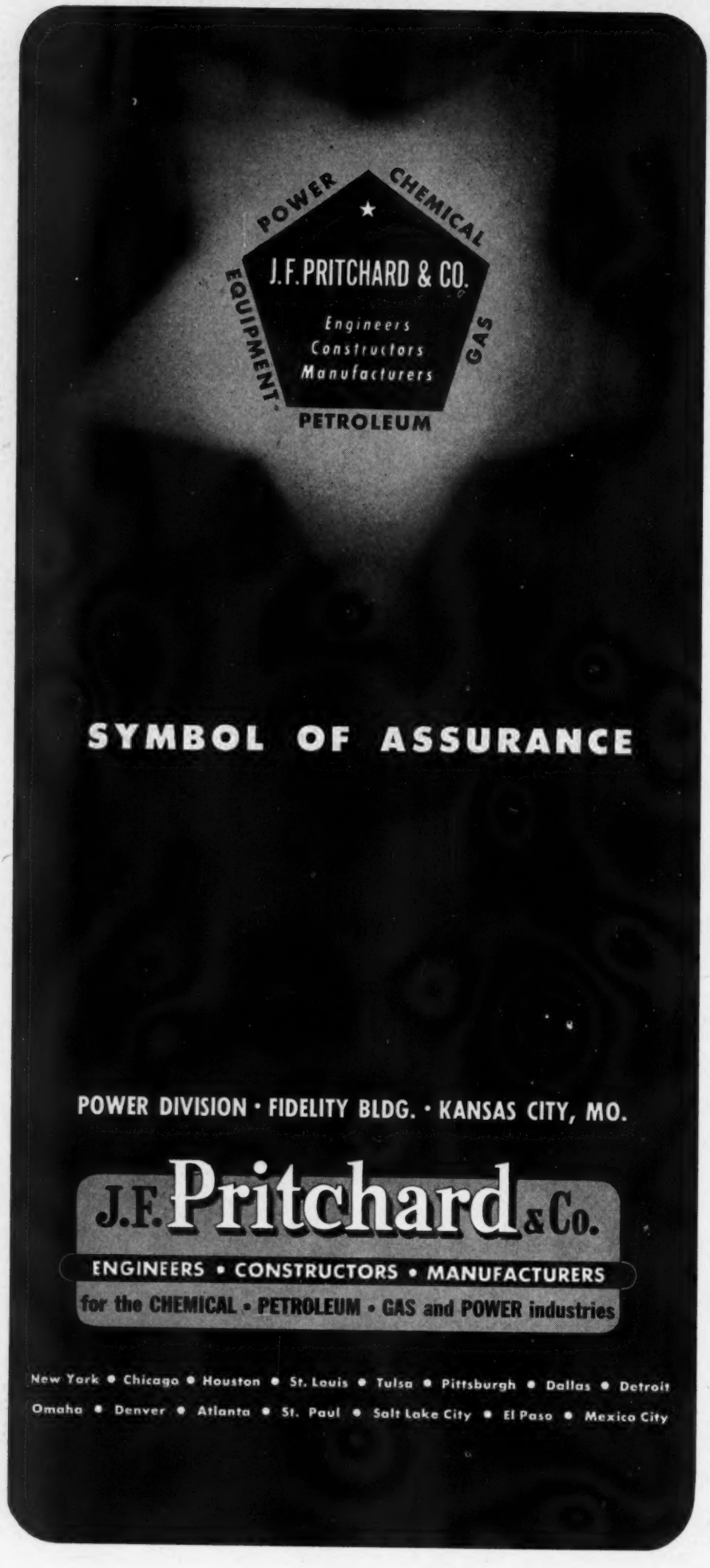
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of sub-contractors involved. He was awarded the Army Commendation Ribbon for meritorious service in administering the settlement of these contracts.

OBITUARY

William G. Hickling

William G. Hickling, 50, vice-president and general manager of the New York State Electric & Gas Corp. with headquarters at Binghamton, N. Y., died of a cerebral hemorrhage, April 10, at Memorial Hospital in Syracuse, where he had gone on a business trip.

Hickling joined the utility in 1941 as a vice-president, going from Erie, Pa., where he was president of the Erie Lighting Co., an affiliate of the Pennsylvania Electric Co. He was in charge of operations and construction for the New York utility until 1945 when he was made general manager. In this position, he coordinated the firm's operations in parts of 43 counties and supervised its power stations and transmission lines.

A native of Connecticut, he spent his youth in Dawson, Yukon Territory, but returned to Connecticut to attend the Sheffield Scientific School at Yale University.

After serving in the Army Signal Corps during the first World War, he became an engineer for the Penn Public Service Co. at Johnstown, Pa. In 1936, he became vice-president and general superintendent of operations for the Pennsylvania Electric Co., a successor company, and he went to Erie the following year.

•

Knox Lee

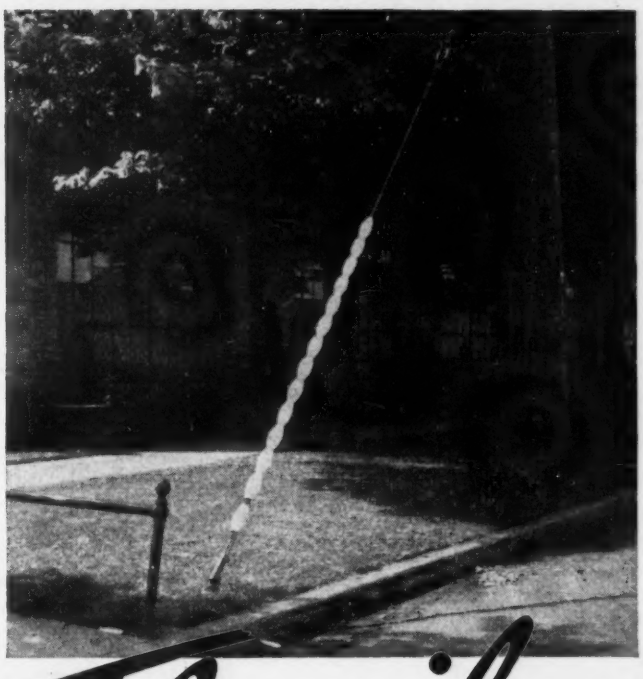
Knox Lee, 60, vice-president, director, and division manager of the Southwestern Gas & Electric Co., died April 9, at Marshall, Tex., following a long illness.

Following his graduation as an electrical engineer from Texas A. & M. College, he entered the electric utility field in 1920 as an engineer for the American Public Service Co. at Dallas. Two years later he joined the East Texas Public Service Co. at Marshall. When this firm was merged into Southwestern, he was made a division manager, a position he held at his death. He was made a vice-president in 1938.

•

► Otto M. Rau, 77, a retired Philadelphia consulting engineer, died April 3, at Miami, Fla., where he has made his home for the past nine years. Rau was one of the pioneers in the electric utility industry and had varied experi-

← You Know what this is

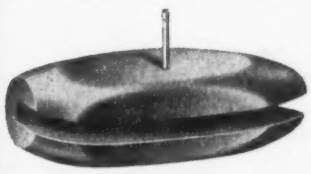


but do you know that the Guy Guard that FULLY PROTECTS is the new modern →

Flexibal GUY GUARD

SEND FOR FREE SAMPLES and make this test

Overton-Flexibal Guy Guards have been field-tested for years in thousands of locations. Customers who try out this modern guard never go back to the old rigid style. It was specifically developed for one of the largest utilities in the country. But you need not take the many recommendations on faith — you can actually find out for yourself. We will gladly supply you with Overton-Flexibal Guy Guards for testing — at no charge. Install them — now — and draw your own conclusions.



The GUARD that Gives with the GUY

Made of hard wood, shaped with rounded contours, aluminum-painted, the 6" spindles which make up the adjustable length of the Overton-Flexibal Guy Guard are literally so many pillows that *give* with the guy. They cushion the shock; never get out of commission. Boxed for ready installation in any desired length. Immediate shipment. Request your testing samples now.

ASK YOUR PUBLIC

Ask the people upon whom you depend for good-will if Overton-Flexibal Guy Guards are not more attractive, more acceptable in all neighborhoods.

ASK YOUR LAWYER

Inquire into the greater protection offered by Overton-Flexibal Guy Guards. They act like pillows in cushioning the shock.

ASK YOUR MAINTENANCE MEN

Get the reaction of the men who have to do the installing and repairing . . ask them if Overton-Flexibal Guy Guards are not the easiest to install, the easiest to handle, the easiest to store, the most resistant to damage of any kind.

ASK YOUR PURCHASING AGENT

Find out how much money the Overton-Flexibal Guy Guard will save you — both in initial cost and in replacement. The P.A. will particularly like the fact that this modern guard is boxed in 5-6-7-8 foot lengths for immediate shipment — no waiting.

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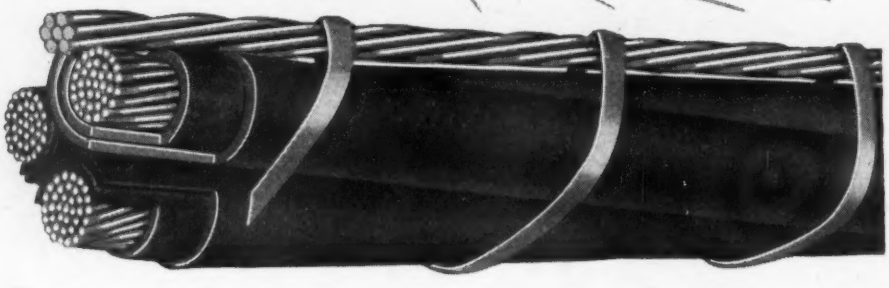
SOUTH HAVEN, MICHIGAN

Collyer

Self-Supporting AERIAL CABLE

DELIVERS *Uninterrupted* SERVICE



THE CONDUCTORS of Collyer Self-Supporting Aerial Cable are insulated with an Ozone Resisting, Oil Base Insulation, possessing excellent ageing properties, high dielectric strength, high resistance to corona cutting, heat, and moisture. The low Dielectric Constant and Power Factor values of this insulation assure efficient circuit operation.

The protective jackets of Collyer Self-Supporting Aerial Cable are of tough, long-lived neoprene. The jacket may be applied over the individual conductors or over the assembled conductors according to the requirements of the customer. Collyer neoprene compound has high resistance to corona cutting, moisture, sunlight, abrasion, and impact. The high chemical resistance of this jacket material protects against deterioration in salt or smoke atmospheres.

The strong messengers — usually of Copperweld — to which the cables are bound, protect against cable breakage or damage from falling limbs and trees. The fully insulated conductors provide insurance against service interruptions under even the most severe conditions when poles are down, and the cables are lying on the ground.

FOR LOWER COST

INSTALLATION

No overlength poles to clear trees.
Less weight.
No cross arms, no grade clamps.
No leading through rings.

OPERATION

Protection against service interruptions due to falling limbs, trees and poles.
Easy to tap — can be tapped hot.

MAINTENANCE

Tree trimming practically eliminated.
No ring cutting.
No lead to crack.
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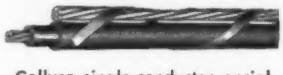
Relieves wire congestion on poles.

Plus

IMPROVED APPEARANCE AND REDUCED PUBLIC HAZARD



Collyer single-conductor aerial cable complete with messenger.

Write for information

Collyer INSULATED WIRE CO.

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ence with many small utilities which have long been out of business. At one time, he was employed by the Edison General Electric Co. of New York. Later he went to Milwaukee to supervise construction for the Milwaukee Electric Railway & Light Co. Later, he went to Philadelphia where he did considerable rate and valuation work for utilities. He first became an associate member of The American Institute of Electrical Engineers in 1903.

▶ PHILIP E. HOPKINS, 60, superintendent of power for the Public Service Co. of Northern Illinois, died March 28. He had been associated with the company's operating and engineering department for 36 years, the last ten as superintendent.

▶ HARRY J. HARZ, 50, for 18 years sales manager of the power switching division, Electric Power Equipment Corp., died recently of a sudden heart attack. A native of Philadelphia, he entered the electrical field with Elpeco in 1917, after studying electrical engineering at Drexel Institute.

▶ EDWARD J. NEIFING, 41, chief electrical engineer for the Cannon Electric Co., Los Angeles, died recently. He went to Los Angeles from Chicago in 1925 to join Cannon.

▶ HAROLD E. KIEFER, 50, specialist in office operations for the lamp department service districts of General Electric Co., with headquarters at Nela Park, Cleveland, died in Los Angeles, April 8, while on a business trip in the interest of the company.

▶ WILLIAM H. LAMB, superintendent of the electrical department of the North Terminal Station of the Boston & Maine R.R. in Boston, died April 9, at Haverhill, Mass., while on leave of absence because of poor health.

▶ ALFRED A. HANDLER, 63, chief forging engineer for the Aluminum Co. of America since 1944, died April 2, at Miami Beach, Fla., where he was on vacation. His headquarters was at Cleveland.

▶ CHARLES A. CADWELL, 76, for the last 36 years engaged in research in electricity and metallurgy for the Electric Railway Improvement Co., died March 27, in Cleveland.

▶ CARL E. MORRISON, 57, former owner of the Earle Power & Light plant, died April 10, at his home in Earle, Ark. His power properties are now a part of the Arkansas Power & Light Co.

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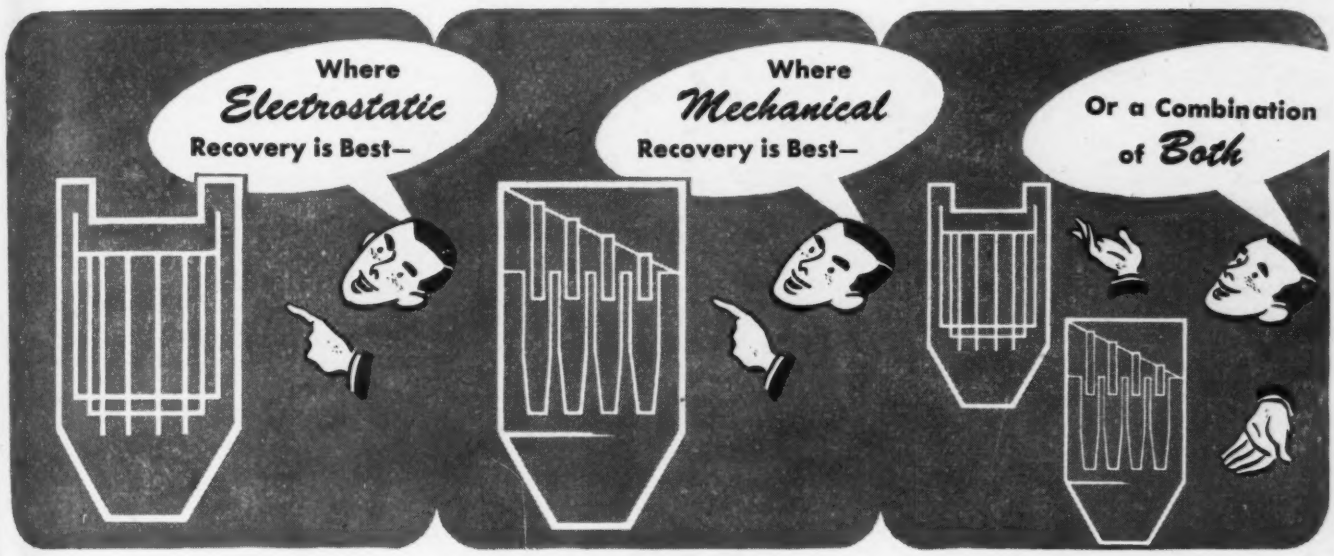
Western Precipitation provides for simplifying YOUR Fly Ash Recovery Problems..

If you are not sure whether yours is a job for Cottrell or mechanical separation methods, you'll get an unbiased recommendation from Western Precipitation Corporation because this organization designs, engineers and installs BOTH!



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Western Precipitation is the organization that pioneered the first commercial application of the now-famous Cottrell Electrical Precipitator. And its unique advancements and refinements in the basic methods, developed through more than 38 years of first-hand experience in Cottrell installations, assure you of the most modern in electrostatic recovery equipment from Western Precipitation Corporation. Cottrells handle dust, fume, fly ash, mists and other suspensions with high efficiency.

THE MULTICLONE MECHANICAL COLLECTOR

Companion to the Cottrell is Western Precipitation's widely used *Multiclone* equipment which offers far-reaching advantages in the mechanical separation of solids from gases. Its unique vane design makes possible multiple *small*-diameter separating tubes that combine high recovery efficiency with maximum compactness, minimum maintenance and wide-range adaptability to varying installation requirements. For mechanical recovery of solids, *Multiclone* is unsurpassed in operating efficiency, economy and installation simplicity.

COTTRELL AND MULTICLONE

And here's a priceless advantage provided by Western Precipitation Corporation... Frequently there are recovery problems where maximum efficiency and economy in first cost are obtained by using *Cottrell* and *Multiclone* equipment working together. There are many such recovery jobs—fly ash is one, perhaps yours is another—and you can get such a combination installation from one organization, under one responsibility, with one overall guarantee by bringing your recovery problem to Western Precipitation Corporation.

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REGARDLESS OF YOUR RECOVERY PROBLEM OR YOUR LOCATION

you can benefit by Western Precipitation's leadership and long experience in the science of recovering suspensions of all kinds—both liquid and dry—from gases, hot and cold. Western Precipitation Corporation installed the first successful Cottrell which is still in operation after 35 years of service. No matter what your industry, Western Precipitation is prepared to serve you in *all* parts of the world. Write, wire or call our nearest office.

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MANUFACTURERS & MARKETS

Allis-Chalmers Production Normal May 1, Walter Geist Says; Future Bright

With the termination of the long strike and with a heavy backlog of equipment orders, Walter Geist, president, Allis-Chalmers Mfg. Co., stated to the press last week that production was building up fast and "would be at normal rate about May 1." He also stated that "there should be no difficulty in doubling our best peacetime output."

Present backlog of the company totals $150,000,000 which is sufficient to keep the plants busy for about one and one-half years, it was indicated. Immediately after the strike many new orders were received, with delivery, in numerous instances, scheduled for 1950.

Sees Utilities Hard Pressed

Geist said that, since utilities are heavily engaged in long range planning and consequently equipment will be in heavy demand, operating companies may be hard pressed for that equipment for at least five years.

Typical of heavy equipment now going through the shop are:

A 103,000 hp. hydraulic turbine for Shasta Dam to run a 75,000 kva. generator. The $603,000 unit will be known as Shasta No. 5 and is similar to four other units already installed.

A $1,750,000, 80,000 kva. complete generating unit including a turbo-generator, condenser and pumping equipment for the Port Washington No. 3 station.

About $1,600,000 worth of electrical equipment for the new Sparrows Point (Md.) rolling mill of the Bethlehem Steel Corp.

Although production was seriously hampered during the strike, Geist continued, research on product development, production technique and fabrication methods continued. Specific research projects were carried on in transformer construction, circuit breaker design, and electronic measurement of line voltage and current. Research continued in the atomic power plant and in the further development and application of the betatron and synchrotron.

Commenting on the attitude of workers who have returned following the strike, he said, "It's a tonic to walk through the plant and see everything running so smoothly. Now that we've got rid of the trouble makers (ELECTRICAL WORLD, April 19, page 22) we don't anticipate any more trouble."

In reply to the question whether industry generally could reduce prices, Geist said he didn't know but he would like to see an analysis of a large number of representative corporations.

"It might be surprising to see how many could make reductions," he said. "Allis-Chalmers, however, was never a big money maker. I would like to see a 5 percent profit after taxes. In 1945, we had only 2.6 percent. We must be old-fashioned in our thinking. We must produce more for less to make more. We're all tied up with the philosophy that we're going to be paid more for working less. I don't want to put any ceilings on earnings if they are based on production. But, I don't know how much higher we can go."

Geist concluded by saying, "I am very optimistic about the future." He expects Allis-Chalmers employment to level off at about 25,000 in its eight plants, which is 50 percent above the pre-war 17,000. At the West Allis plant there are now about 8,000 production workers and 5,000 office personnel. He expects this to return to about 16,000.

•

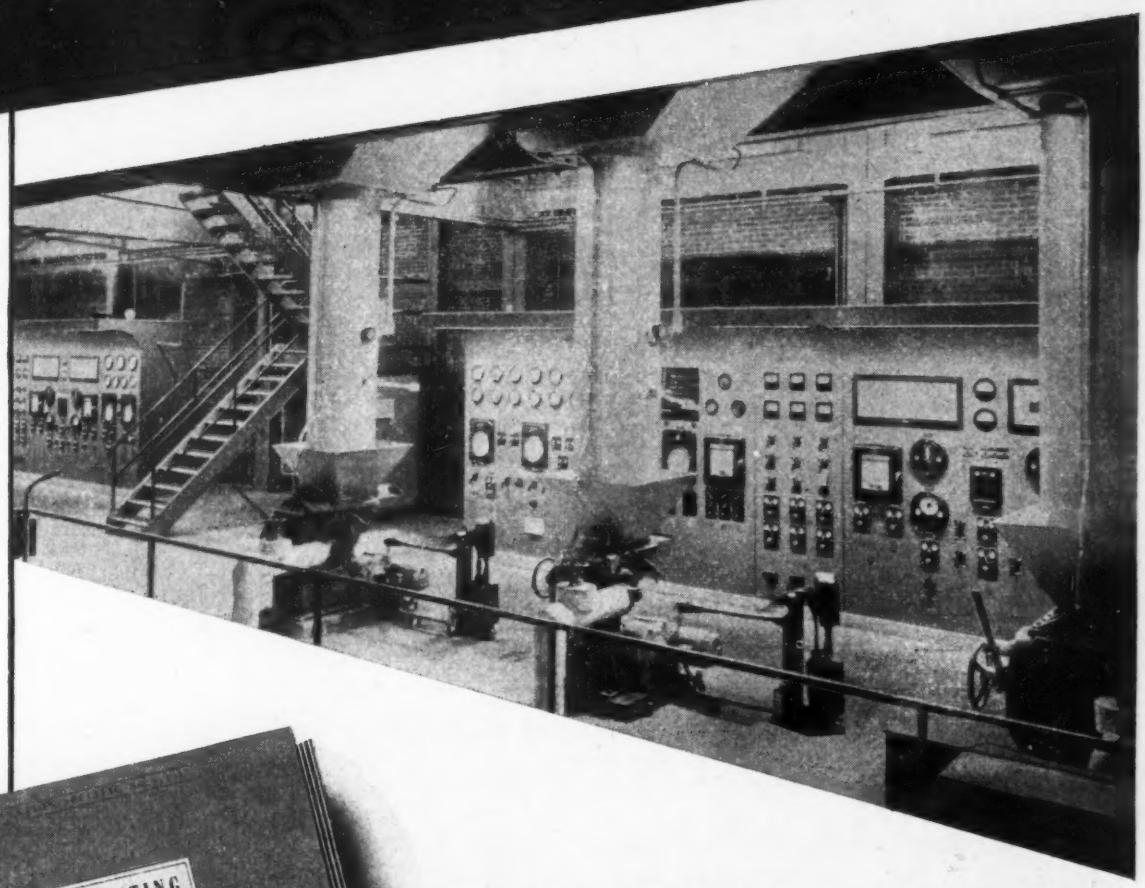
$1,000,000 for Education

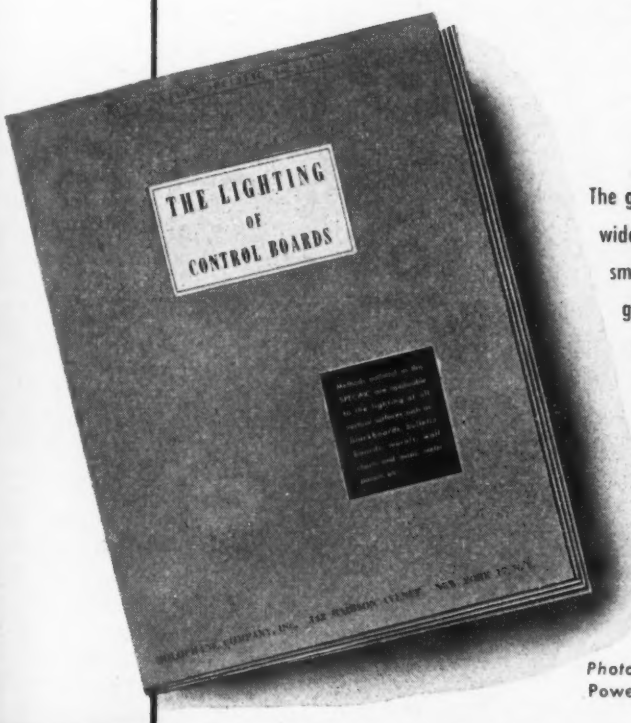
More than $1,000,000 will be spent during 1947 on employee education by the General Electric Co., W. W. Trench, chairman of the company education commitee, announced recently. More than 500 instructors will take part in instructing the 12,000 employed stu-

THE LAW SAYS—Vivien Kellems on Tuesday last week defied the Connecticut labor statute which prohibits women from working in industrial plants after 10 p.m. Miss Kellems invited prominent society women to report for work at the Kellems Co. cable-grip factory in Saugatuck to test the law. Excerpts of what she termed "this idiotic law" were read to the "one-night employees." The state labor department ignored the breach of the statutes

Holophane

write for the new Holophane book on CONTROL BOARD LIGHTING





The greatly increased use of control boards, not only in power plants but in a wide range of industry, calls attention to the importance of illumination for smoother, safer operation . . . Specific Holophane Controlens units provide glareless shadow-free lighting of the vertical areas, making it possible for operators to read the meters from any normal viewing position.

Holophane engineers have condensed the experience gained from many successful installations into a new book, "Lighting of Control Boards"... This book treats the basic problems of meter-board illumination; includes practical recommendations and typical calculations for predetermining the exact type of lighting required for each new situation . . . Write for free copy today—no obligation.

Photo above, courtesy Union Electric Co. of Illinois . . . Venice No. 2 Power Plant; Venice, Ill. . . . Engineers: Stone & Webster Engineering Corp.

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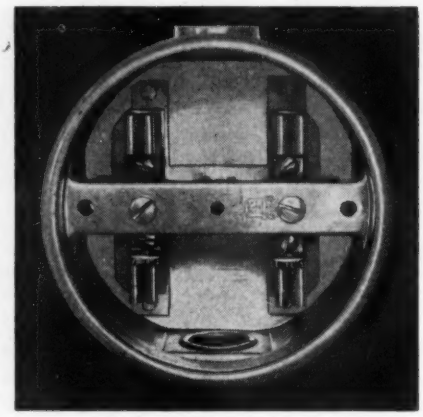

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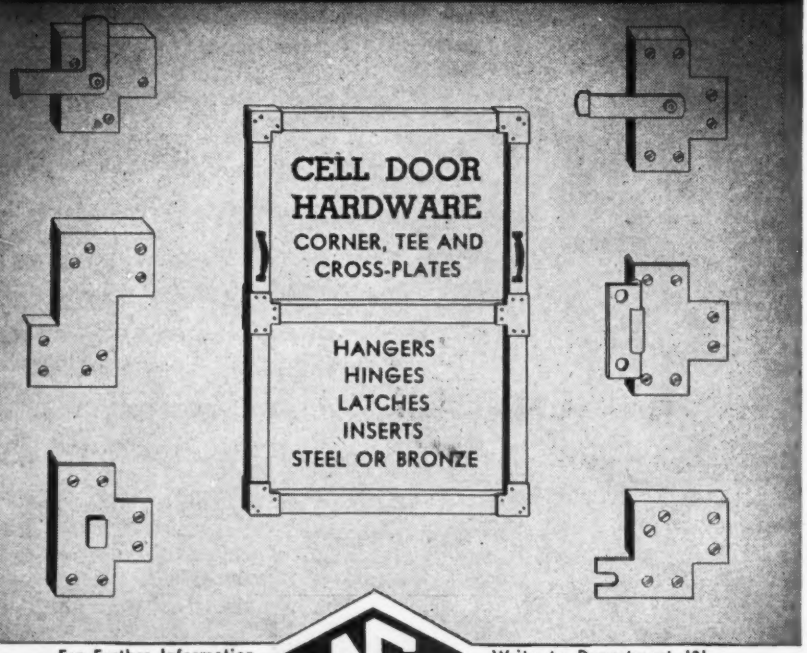
PROVEN PRODUCTS



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dents. The monies will be utilized in carrying on the test course, business training course, and apprentice training programs.

•

Wage Agreements Minimize Strike Possibilities

Agreement by Westinghouse and General Motors and their respective unions on wage questions and probability of an early agreement between General Electric and its union on the same question appear to minimize the possibility of long strikes in the industry during 1947. The Westinghouse agreement provides for a 15-cent per hour increase in settlement of all economic issues and is similar to that reached last week at General Motors.

A settlement between the union and General Electric is all that remains to forestall a repetition of last year's nationwide strikes in the electrical manufacturing industry. It has been indicated that the G. E. union would accept a similar proposal. Although not confirmed, it is believed that such an offer will be forthcoming.

Charles E. Wilson, General Electric president, declined to reveal the company's plans. He stated the union asked for a recess two weeks ago, and it was during this period that agreements were made with General Motors in Detroit and Westinghouse in Pittsburgh. Conferences are expected to resume later this week.

At Westinghouse, the agreement covers 75,000 production workers and salaried personnel. W. G. Marshall, Westinghouse vice-president, and James J. Matles, director of organizations, United Electrical, Radio & Machine Workers of America, C.I.O., issued a joint statement which states "Effective April 1, 1947, all wage rates of hourly rated employees represented by the U.E-C.I.O. will be increased 11½ cents per hour; the remainder of the 15 cents will be used to cover the cost of six paid holidays, three weeks' vacation for employees with 20 years' service and other economic issues."

Salaried employees will receive $5.00 per week increase, similar vacation considerations and improvements in overtime provisions. The agreement is subject to ratification by the Union Conference Board of Westinghouse locals and the membership, after which it becomes binding on all economic issues until April 1, 1948.

Negotiations have been continuing since early in January. The negotiations were carried on under the leadership of W. O. Lippman, Westinghouse vice-president in charge of plant labor relations, and Edwards J. Matthews, international representative of U.E.-C.I.O.

THE HIGH-VOLTAGE COUPLING CAPACITOR

that paved the way to Low-Cost Carrier Telephone Systems

Thanks to the development of the Sprague High-Voltage Coupling Capacitor, one line —the power line—can now provide both power and telephone services in rural areas on the Rural Electrification Authority System.

When the entire rural carrier current telephone program was stymied and about to be junked for want of a safe, low cost means of coupling telephones to a 7200 volt distribution line, *Sprague came through.*

The Sprague coupling capacitor is a safe, low cost, hermetically-sealed, corona-free coupling unit only one-tenth the size and weight of other capacitor types formerly considered for this purpose. It is glass enclosed and completely weather proof.

Although operated on 7200 volt distribution circuits in this case, Sprague High-Voltage Coupling Capacitors will withstand ten 1½ x 40 microsecond test impulses of 95 KV.

This .002 mfd. capacitor is conservatively rated at 8700 volts, 60 cycle AC.

SPRAGUE ELECTRIC COMPANY
NORTH ADAMS MASSACHUSETTS

HAVE YOU A COUPLING CAPACITOR APPLICATION?

In furtherance of their extensive coupling capacitor research, Sprague engineers will welcome the opportunity to discuss other applications where high-voltage units of this general type may prove useful.

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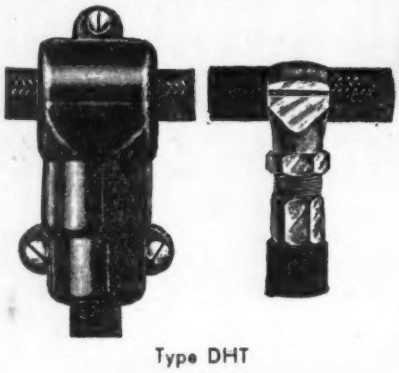
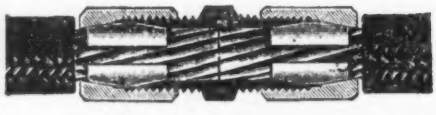
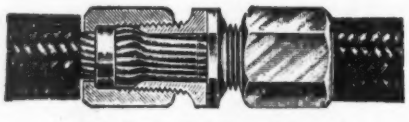


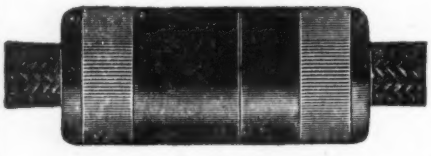
Type DHT



Two-Way Type "A" Construction



Two-Way Type "B" Construction



Two-Way Cover Type TWC

DOSSERT CONNECTORS

TYPE DHT

A hook type cable tap connector. The contact surface of the hook section and the compression gland are accurately machined to fit the conductor run, while the tap off section is available in the type "A" or type "B" construction illustrated below. This connector is available with an insulating cover for making compact insulated connections as illustrated.

TYPE TW

A two way connector for coupling cables on end. Available in the type "A" or type "B" construction as illustrated. The type "B" construction develops many times the tensile strength of the conventional fitting. For instance with a 500MCM cable the tensile strength is 5,350 lbs. Both connectors are available with insulating covers type TWC to make an insulated joint as illustrated.

Send for literature on the type "B" construction which outlines comparative strengths and cable anchor applications.

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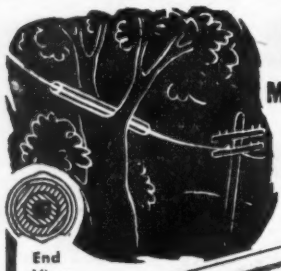

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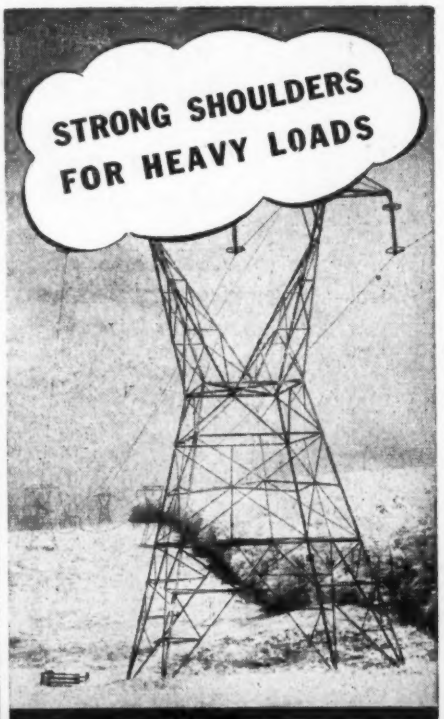

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Recent Rate Change

BUFFALO NIAGARA ELECTRIC CORP., as of April 14, reduced commercial and industrial rates in Allegany, Cattaraugas, Chautauqua, Livingston, Ontario, and Wyoming Counties and in parts of Erie, Genesee, Monroe, Niagara, and Orleans Counties. The reduction will amount to as much as 2 cents per kw.-hr. in some classifications. The total reduction is estimated at about $350,000 annually. Rates will begin at 70 cents for the first 14 kw.-hr. used.

•

Extends Welding Service

To aid in extending service to all users of electric arc welding the Lincoln Electric Co., Cleveland, has appointed seven new welding sales engineers. They include: Marvin Anderson, appointed to the Moline, Ill., office; Albert Bavaria, Philadelphia; Richard Freundlich, Cleveland; Paul Holden, Franklin, Pa.; Richard Nelson, Syracuse, N. Y.; Richard K. Reynolds, Detroit; John E. Williams, Syracuse, N. Y.

•

F. M. Gates & Co. Expands

With the purpose of expanding into a broadened field of usefulness in the business of engineering and manufacturing electric farm equipment and associated products, F. M. Gates & Co., Plainville, Conn., has reorganized as the Smith-Gates Corp. Howard S. Smith, for several years manager of the farm electric equipment division for the Trumbull Electric Manufacturing Co., has associated himself with the new company as president.

•

Home Freezer Price Cut

A reduction of $51 on two models of home freezers was announced recently by John M. Bess, executive vice-president, Noma Electric Corp.

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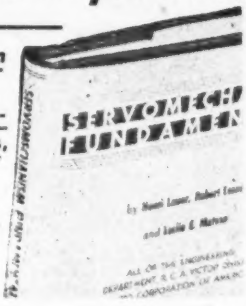

Here, at last, is real, practical aid in designing servomechanisms—a presentation of theory, specific design procedures, and helpful test procedures, that will enable you to fulfill specified operating requirements, get the satisfaction you want from an automatic control system. The book analyzes various servo systems—those with viscous output damping, error-rate damping, integral control, etc. It presents scores of problems like those you actually encounter in servomechanism design, with the working formulas, curves and diagrams necessary for their solution.

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BOOK REVIEWS

Radiant Heating. By T. Napier Adlam. Published by The Industrial Press, New York 13, N. Y. 472 pages. Price $6.00.

Electrical methods of panel heating and snow melting (feasible "where electricity is cheap") are treated quite briefly, the emphasis throughout being upon piping systems for floor, wall and ceiling panel installations. Nevertheless the hopeful advocate of electrical applications (not excluding the heat pump, hardly mentioned) will find here the quantitative data which pertain alike to pipe and wire methods of delivering the low-temperature heat. Profuse tabular and curve information is given for a wide range of imbedding materials and construction. Ample attention is given to controls and to the matter of air circulation, ventilation and humidification. If electrical radiant heating makes progress it will do it in the face of the comprehensive facts and experience recorded here.

Anatomy of Depreciation. By Luther R. Nash. Published by Public Utilities Reports, Inc., Washington 4, D. C. 214 pages, illustrated. Price $5.

Depreciation accounting theory has been argued, adjudicated and annotated into progressive obscurity, despite the current commission preference for the straight-line approach. Electric utilities in general continue advocating the retirement reserve procedure. Nash, with a wealth of experience from participation in the cases and in committee delibrations, puts down here the techniques, consequences and implications of each concept as well as the various modifications called by other names. He traces their origin and evolution and shows how the straight-line method came to be imposed despite the excessive accumulations it occassions and despite the unreality of the service-life assumptions on which it is based.

He demonstrates how the asserted defects of the retirement reserve method can be obviated with full jusitce to customer, invester and public. Along the way his dissection is executed with incisive analyses and with annotation to a sufficient but unobtrusive degree. As a consequence the book is virile exposition of the pros and cons in the language of the engineer-accountant, much less forbidding and much more appealing to engineer and accountant than if it had been couched in legalistic rigor—and obscurity.

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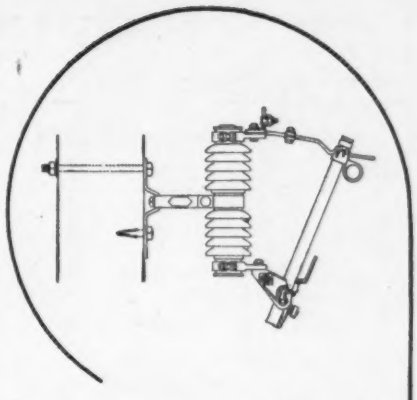

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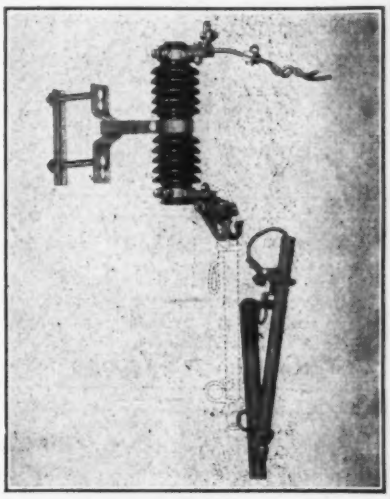

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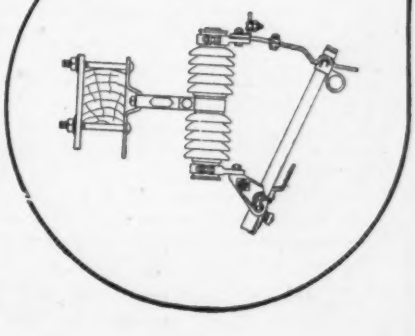

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